ELECTRICAL REVIEW

THE PIONEER ELECTRICAL WEEKLY OF AMERICA

VOL. XLIX. No. 19. NEW YORK, SATURDAY, NOVEMBER 10, 1906. ISSUED WEEKLY

CHARLES W. PRICE . . . . . PRESIDENT AND EDITOR
STEPHEN H. GODDARD . . . . . SECRETARY AND MANAGER
WM. HAND BROWNE, JR. . . . . TECHNICAL EDITOR
AINSLIE A. GRAY . . . . . MANAGING EDITOR

NEW YORK
PUBLISHING OFFICE . . . . . 13-21 PARK ROW
CHICAGO
WESTERN OFFICE, L. W. MARSHALL, Manager, . . MANHATTAN BUILDING
BOSTON
NEW ENGLAND OFFICE, ... 95 MILK STREET
LONDON
EUROPEAN OFFICE, HENRY W. HALL, Manager, 42 OLD BROAD STREET, E. C.

TELEPHONE AND CABLE
TELEPHONE "21 Cortlandt." Private exchange to all Departments.
REGISTERED CABLE ADDRESS: "Electview," New York.

SUBSCRIPTIONS

One Year, United States and Canada	$3.00
One Year, Foreign Countries	5.00
Single copy, 10 cents. Back numbers, beyond one month, each	.25

ADVERTISING

CHANGES for advertisements should be in this office by *Friday noon* for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than *Monday noon* to assure publication in that week's issue.

Entered at the Post Office at New York as second-class matter under the Act of March 3, 1879.

CONTENTS

EDITORIAL:
Domestic Electricity 745
A New Method of Regulating Alternators 746
Useful or Useless Races 747
The Radio-Telegraphic Conference 747
Fuel, Water and Gas Analysis for Steam Users, by John B. C. Kershaw. 748
Second Annual Electrical Show at Chicago 751
Changes in the Personnel of the Engineering Staff of the New York Central & Hudson River Railroad 751
Adaptations of Electrically Driven Conveyers, by Day Allen Willey 752
Electric Lighting by Wind Power 753
The Rejuvenated Sons of Jove 753
English Electrical Notes 754
New York State Telephone Developments 755
A Combined Heating and Lighting System at Canton, Ohio, by R. W. Hutchinson, Jr. 756
A Prayer to the Wiremen 758
Annual Report of the Western Union Telegraph Company 758
The Growth of the Westinghouse Interests 759
English Experiment of Shipping by Electric Wagons 760
Cooperative Electrical Development Association 760
Electrification of the West Jersey & Seashore Railroad—II 761
The Production of Platinum in 1905 765
Electric Railways in Sparsely Settled Communities (Concluded), by E. P. Roberts 766
Electrical Machinery Breakdowns 768
Berlin Street Lighting 769
The New Muspratt Laboratory of Physical and Electrochemistry at Liverpool University, by John B. C. Kershaw 770
The Alaskan-Yukon-Pacific Exposition of 1909 770
Handling Public Complaints, by John A. Beeler 771
An Electric Car Brake 773
New York Electrical Society 773
Exposition of Safety Devices 773
REVIEW OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE 774
Report of the Alameda (Cal.) Municipal Light Plant 776
Results by Telephone 776
Electrically Lighted Railway Mail Cars 776
METHODS OF GETTING NEW BUSINESS 777
The Lighting of Railway Cars by Electricity 778
INDUSTRIAL SECTION:
Mechanical Time Recorders 779
Hydroelectric Contract for J. G. White & Company 779
A New Electric Blue-Printing Machine 779
American Ball Engines and Generators 780
The New Holophane Reflecting Arcs 780
Western Electric Belted Alternator 780
Allis-Chalmers Oil-Insulated Transformers 781
Electrical Equipment of a Modern Steam Laundry 783
Window Lighting 783
Illustrated Lectures on Illumination 783
CURRENT ELECTRICAL NEWS 784
DIRECTORY OF ELECTRICAL AND ALLIED ENGINEERING AND SCIENTIFIC SOCIETIES 790
RECORD OF ELECTRICAL PATENTS 791

Copyright, 1906, by Electrical Review Publishing Co.

DOMESTIC ELECTRICITY.

A valuable feature of the electrical appliances which have been devised to bring comfort to the housekeeper has been the convenience of the apparatus. The chafing-dish and the broiler are always ready for service, the electric iron is always hot and maintains a constant temperature, and, in fact, to bring any one of these little devices into service requires merely the turning of a switch. There is no doubt that this feature is a most important one. This readiness to serve, if it went with no other advantage, would be sufficient to overbalance a considerable disadvantage in the matter of first cost and cost of operation, if such exist.

But there is a feature of these electrical devices which, while recognized in a way, does not seem to have been given sufficient emphasis. This feature is very strikingly brought out by Mr. H. W. Hillman in the current issue of *Cassier's Magazine*. Mr. Hillman not only calls attention to the readiness-to-serve feature, but shows how this feature brings with it other and important advantages. An electric egg-boiler, for example, when supplied with a small quantity of water, produces steam in forty-five seconds, which, added to the three minutes required to boil the eggs, gives three minutes and forty-five seconds as the entire time in which the device is in use. When the eggs are boiled in the old way, it is customary to put on a quart or so of water over a gas burner or a coal stove and to allow five or ten minutes or more in order to bring the water to the proper temperature, so that the total operation requires three or four times as long as the new method, and at the same time is much more wasteful because of the large amount of water heated. The same system—that is, cooking by steam generated in an electric heater—may be applied in preparing other foods, for which purpose it is just as economical. Nearly all the heat developed by the electric heater is taken up by the water, and nearly all of this is utilized in preparing the food. There is almost no waste. This is a feature which is worthy of being dwelt upon more at length.

There is no doubt that a feeling exists among possible users of electrical household appliances that with all their advantages and conveniences they are too expensive for ordinary use because of the relatively high cost of a unit of heat when produced in this way. It is true, of course, that electrical energy is energy in an exalted form, which has been obtained only at considerable sacrifice and it must, therefore, be sold at figures which, per unit of heat produced, seem high. But the point brought out by Mr. Hillman leads one to wonder whether, after all, the system is not really a cheap and economical one. In the

ordinary operations of a kitchen range or gas stove the heat losses are enormous; in fact, they amount to nearly all of the heat developed, at least in the case of the coal stove. The matter seems to be a small one for each individual householder, but when it is remembered that the same wasteful method is going on in every house it is evident that the aggregate loss is considerable, and one well worthy of avoiding. The loss is due, of course, to the intermittent character of the work and to the badly designed apparatus for utilizing the heat. It would be interesting to compare, on a heat-efficiency basis, the performance of the coal stove, the gas range and the electric heater, starting, of course, with the coal pile and finishing with the heat actually delivered to the prepared food. It might be found that the electrical system, although it seems to be a roundabout way, is, after all, the least wasteful.

This feature is found also in other electrical appliances. They are always ready to work and are remarkably efficient. And it might even be found that for such purposes as heating a room for a short time in the morning and evening that an electric heater, even with energy at a few cents per kilowatt-hour, would cost less and give more comfort than a good type of coal furnace, for, in order to obtain heat from the latter for a short time in the morning and at night requires that it be kept going continuously. Mr. Hillman seems to think that this feature of electrical appliances—that is to say, the thermal efficiency with which they perform their operations—goes a long way towards making that operation no more expensive than if performed in any of the older ways; and the fact that he uses many electrical appliances throughout his house for cooking, lighting and even heating the rooms in spring and fall, and that his average monthly bill for electrical energy for the past two years has been only $6.69 at a price of five cents per kilowatt-hour, lends considerable force to his arguments.

So far the problem has been looked at from the point of the consumer only, but the desirableness of the load from the standpoint of the central station would doubtless lead the latter to make some inducement, and in this way build up a very economical load curve. One can not look for any startling development in this field, but it is a fact that the use of these appliances has increased during the past year or so much more rapidly than was anticipated, and there is every likelihood that it will go on increasing at a greater rate.

A NEW METHOD OF REGULATING ALTERNATORS.

A great many ways have been devised for controlling the performance of alternating-current generators so as to give either a constant voltage or one rising with an increase in the load. Practically all plans that have been tried for accomplishing the same purpose in direct-current design have been applied to alternators. With an alternating machine, however, the problem is, no doubt, more difficult, because the demagnetizing action of the armature depends upon two factors which are not necessarily related. An increase in the armature current sets up an increased demagnetizing force as does also an increase in the angular lag of the current with respect to the electromotive-force. Any perfect system of compounding or compensating an alternator for all loads must therefore provide for these two actions, and it is the difficulty of doing this that caused so many attempts at compounding alternators to fail.

The first plan of compounding an alternator which was naturally suggested was simply to add series turns to the alternator fields and supply these with rectified currents from the armature. The plan worked satisfactorily for purely lighting loads, but when alternating-current motors began to be used it no longer met the requirements. This led to various devices for meeting the new difficulty. The use of condensers and of over-excited synchronous motors to correct the power-factors of an inductive load was suggested and even tried, but never met with encouragement. One of the prettiest solutions is that due to Rice, in which advantage is taken of the shifting of the phase of the armature reaction of the alternator to compound an exciter mounted on the same shaft. Another plan was proposed by A. Heyland, which really developed from his method of winding induction motors so as to increase the power-factor.

Now Heyland has come forward with another plan which is very pretty in theory and which attacks the problem in a new way. Frequently it has been found, particularly in electrical engineering, that certain reactions which give a great deal of trouble at first can be so utilized as to correct the very trouble they cause. This is the case with the new method; as the increasing armature reaction, due either to an increase in the armature current or a change in its phase, is made to compound the exciter field, and thus avoid the decrease in electromotive-force which would otherwise result. This method is described in *L'Éclairage Électrique* (Paris) for October 20, and a brief abstract of the article appears on another page of this issue.

In brief, Mr. Heyland recognizes the two components of armature reaction, the cross-magnetizing and demagnetizing effects, and he utilizes the latter. This is done by turning off alternate pole faces of the alternator field so as to increase the air gaps and thus unbalance the magnetic system. The effect of the demagnetizing component of the armature reaction will then be to set up magnetic leakage, which, under these conditions, would tend to pass through the shaft of the alternator. If, upon this same shaft, the armature of the exciter be mounted, the leakage flux will tend to complete the circuit through the armature and field cores of the exciter and the frame of the alternator, provided no other path be offered. This would weaken one-half of the exciter poles as much as it strengthened the other, unless special provision were made to utilize it, which is done by turning off, as in the case of the alternator, the alternate poles of the exciter field, leaving a smaller air gap at those poles, which would be strengthened by the leakage flux. To prevent this difference in the air gap producing unbalanced electromotive-forces in the alternator, those poles having the longer air gap are provided with more turns in their exciting coils, so that when there is no armature reaction the flux through the different air gaps will be equal. The action of this arrangement is as follows: With the machine running unloaded the armature, of

course, has no effect, but as the load goes on the leakage flux set up by the reaction passes through the shaft and the exciter armature and fields in such a way as to strengthen them. This effect increases not only with the armature current, but with the angle of lag of an inductive load on the generator, since the demagnetizing components of such currents are greater. Some control over the amount of regulation can be made by controlling the field strength of the exciter, but the inventor of the method believes that when once adjusted it will take care of all load variations.

The method is not only very simple in that it calls for no additional circuits on either machine, but, as well, because it makes direct use of the very reaction which affects the regulation of the machine. Moreover, since it utilizes the magnetic forces it is applicable to generators and exciters having different numbers of poles; a feature which makes direct electrical compensation difficult. In the article referred to no account is given of any practical test of the system, so it is yet a question just how perfect the compounding will be; but since there are various methods of changing the degree of the effect, either by varying the relative lengths of the air gaps or by changing the relative magnetizations of the alternator and exciter, there seems to be no reason why a small cause at the alternator armature should not produce a considerable effect at the exciter fields. In fact, Heyland proposes adjusting the apparatus for half load, so that the variation in magnetization will be both up and down, and he expects to be able in this way, with a small total leakage flux, to over-compound his alternator to any desired extent.

USEFUL OR USELESS RACES.

Two recent events attracted world-wide interest. One was the Vanderbilt cup automobile race on Long Island, and the other was the balloon race starting from Paris and finishing in England. The contestants in both of these races were men of means or men well paid for doing what they did, and therefore no one should complain at what seems to be a waste of time and a useless risk of life. With respect to the automobile races, it may be said by the manufacturers that they assist in eliminating weak features and suggest means of improvement; yet the type of car best suited to an average speed of sixty miles an hour is not one that is best suited for ordinary conditions. It is probable that the advertising feature of the race is the one given the greatest consideration by those companies whose cars took part.

Regarding the balloon race, on the other hand, there is still less to recommend it. Few, if any, believe that the gas bag offers a solution of the problem of aerial navigation, and certainly there is little to be learned by casting oneself upon the mercy of the winds in such a contrivance. This much may be said for this great race, that those who took part in it did so as a matter of choice, and for the excitement which it furnished, and if they chose to take the risk of being dropped from the clouds or blown out to sea, they were free to do so. But it seems rather a pity that these contestants, and, in fact, most of those daring persons who are undertaking balloon flights, should waste their time and their efforts and their money in such useless ways. Why do they not turn their skill—such as it is—and their means, as well as their courage, into more useful channels? If they wish to go up in balloons why do they not seek some useful end at the same time? We know too little about the air to-day. Studies could very properly be made of air currents, air temperatures and electrical conditions which, if carefully carried out, would be of great scientific and practical importance. Such data as we have in this field have been gathered from a few isolated balloon ascensions and by means of a few kites, while if all those who now have balloons would turn their energies towards increasing this knowledge there is no doubt that they could very shortly increase our information greatly; and the satisfaction of knowing that they were conducting useful experiments would probably, in the end, be greater than that of being the lucky man whose balloon was blown the farthest.

THE RADIO-TELEGRAPHIC CONFERENCE.

The result of the recent international conference which met in Berlin to straighten out some of the tangles that have arisen from the growing use of wireless telegraphy—or, rather, radio-telegraphy, as we suppose we should say now, since this new designation was adopted by the conference—was, on the whole, rather successful. Although the rules adopted by the conference do not settle definitely the one question which has given rise to so much friction, they seem to indicate that there will be less trouble in this matter than heretofore, and that probably it will be settled satisfactorily within a few years. The matter which caused all this irritation was the practice of the Marconi Company of refusing to accept messages sent out from a station or vessel equipped with another company's system. The British post-office and admiralty are so bound up by their contracts with the Marconi Company that the British delegates were forced to make a strong fight against all rules looking to a general exchange of messages. In this they were backed by the Italian delegates, who were in the same position, as well as by those from France and Japan for a time. The final agreement was the adoption of a rule making inter-communication compulsory, but this was limited by making the rule a separate article, so that it becomes binding only upon those powers whose delegates sign it. It is interesting to note that during this conference the position taken by the British delegates was not in accord with the feelings expressed in the English technical papers, and although it was recognized that the contracts made between the British government departments and the Marconi Company have, no doubt, done a great deal in advancing the art, as, by means of them, stations were erected which, from a commercial standpoint, could not be expected to be profitable, still such expenditures must always be made in introducing any new art. Ordinarily this expense is borne by the company which originated the art, but in this case the importance of the new method of communication from a strategic point of view, and the little prospect of its becoming a profitable system within a few years, led to the arrangement which has caused so much ill feeling.

FUEL, WATER AND GAS ANALYSIS FOR STEAM USERS.[1]

BY JOHN B. C. KERSHAW.

IX—The Chemical and Physical Characteristics of the Waste Gases —Sampling the Gases.

1. Chemical Characteristics—The burning of ordinary bituminous fuel in the furnaces of steam boilers is in reality a chemical oxidation of the hydrogen and carbon of the fuel, this oxidation being sufficiently intense to produce light and heat. When this oxidation or combustion of the fuel has been properly carried out, one obtains as products of the chemical changes only carbon dioxide and aqueous vapor; these two being diluted, however, with the nitrogen and unconsumed oxygen of the air. Sulphur dioxide gas is also generally present as an impurity derived from the sulphur in the coal. As already pointed out, it is this ingredient of the waste gases, and not the soot, which destroys vegetation and damages stonework in all great industrial centres where coal is burned on a large scale.

The chemical products of the perfect combustion of bituminous fuel in air are therefore: carbon dioxide, aqueous vapor and sulphur dioxide; with oxygen and nitrogen as diluent gases, derived from the air.

Should the combustion process have been improperly carried out, particles of unconsumed carbon and carbon monoxide gas will be present in the exit gases from the furnace of the boilers; while with very bad management, entirely unconsumed hydrocarbon gases may be found, in addition to those already named.

Semi-anthracite and anthracite fuels contain less hydrogen and, when heated, produce less hydrocarbon gases than bituminous coal. The waste gases from boiler furnaces fired with these classes of fuel as a rule therefore contain little soot or undecomposed hydrocarbons; but, on the other hand, the proportion of carbon monoxide may be high, owing to insufficiency of the air supply.

Coke also is a fuel which may produce large amounts of carbon monoxide when the management of the furnace and of the air supply is at fault. Sulphur dioxide is generally present in large amounts in the waste gases from furnaces fired by coke manufactured from cheap classes of fuel.

It may be pointed out here that, with coke and anthracite, the appearance of the waste gases gives no indication of the composition of the gas, and a clear and apparently satisfactory waste gas may contain large amounts of carbon monoxide and be associated with very bad conditions of combustion in the furnaces of the boiler.

Chemical tests of the exit gas are therefore required to discriminate between good and bad work with coke and anthracite.

When semi-anthracite or bituminous fuels are employed, insufficiency of air supply will cause, as before, carbon monoxide to be present in the exit gases, but in this case, owing to the larger amount of hydrocarbons liberated on heating the coal, smoke will be produced and will serve as a signal that the combustion of the fuel is incomplete.

With these cheaper and more generally employed classes of fuel a chemical examination of the waste gases therefore is not required to prove the existence of bad management of the furnaces and incomplete combustion. The freedom from smoke of the gases issuing from the chimney top is sufficient to indicate whether good or bad conditions exist within the furnaces.[1] It is somewhat depressing to have to state that although bituminous coal of all grades can be burned entirely without smoke production in the furnaces of steam boilers, in nine cases out of ten the correct conditions for perfect combustion are absent, with the result that soot and carbon monoxide, with unconsumed hydrocarbon gases, are allowed to escape in large quantities into the atmosphere.

2. Physical Characteristics—Temperature.—The temperature of the waste gases depends very largely upon the amount of excess air allowed to pass into the boiler furnaces, and upon the cleanliness of the boiler. A large excess of air causes a low initial temperature in the furnace, and a low heat transmission to the water in the boiler. With badly scaled boiler plates the heat of the furnace gases will not be transmitted so rapidly to the water on the other side of the plates, and the gases will consequently carry a larger proportion of their heat into the economizers and flues.

The temperature of the gases is therefore no indication of good or bad work, for it depends upon causes which operate in different directions. An excess of air lowers the temperature of the furnace and of the exit gas, while dirty and scaled plates increases it.

Good work and a high evaporative efficiency of the boiler demand a minimum of air and a high initial temperature within the furnace, combined with a rapid transfer of heat through the plates to the water. The temperature of the exit gases may thus be exactly the same in a boiler which is converting eighty per cent of the heat value of the fuel into steam and in one which is converting only sixty per cent and is allowing over thirty per cent to escape into the flues and chimney. The temperature of the gases issuing from the boiler flues is therefore not a safe guide to the working efficiency of the boiler, though as a general rule the lower the temperature of the exit gases the higher is the evaporative efficiency of the boiler.

Specific Heat—The specific heat of the exit gas varies with the chemical composition and can be calculated when this is known by the aid of the following figures:

Carbonic acid.....	(CO_2)	0.153	At constant volume; with water=1.000.
Carbonic oxide....	(CO)	0.175	
Nitrogen.....	(N_2)	0.173	
Oxygen.....	(O_2)	0.154	
Aqueous vapor...	(H_2O)	0.333	

It is evident that the amount of heat carried away by the exit gases will depend very largely upon the percentage of aqueous vapor present. This, however, varies with the amount of hydrogen present in the fuel and with the wetness or dryness of the fuel when charged into the furnace. The specific heat of the exit gases from furnaces using ordinary bituminous fuel may therefore lie between 0.240 and 0.300. Toole, in his work on "The Calorific Power of Fuels," gives a series of specific heats ranging from 0.312 for five per cent of CO_2 to 0.323 for fifteen per cent of CO_2; but the writer considers that these values are too high unless a very excessive amount of aqueous vapor be present in the exit gases. The importance of specific heat is recognized when calculating the heat lost with the exit gases. Article XII will deal with this subject, and in the calculations there given a constant value of 0.240 for the specific heat of the exit gases will be employed.

Specific Gravity—The specific gravity varies like the specific heat, with the chemical composition of the exit gases, and can be calculated when this is known. The following are the figures for the specific gravity of the gases likely to be present:

Carbonic acid...	(CO_2)	1.529	Experimental figures with air = 1.000.
Carbonic oxide..	(CO)	0.967	
Nitrogen.....	(N_2)	0.971	
Oxygen.....	(O_2)	1.105	
Aqueous vapor.	(H_2O)	0.615	
Sulphur dioxide.	(SO_2)	2.21	

A large percentage of carbonic acid or of sulphur dioxide in the exit gases is therefore accompanied by a high specific

[1]All rights of reproduction and translation are reserved. Copyright, 1906, by John B. C. Kershaw.

[1]Excess of air may produce a "clean chimney top," but will not lead to fuel economy.

gravity. The variations in specific gravity are used in one form of CO_2 testing apparatus, to indicate the percentage of CO_2. Further details of this instrument will be given in Article XI.

Refractive Index—The refractive index of furnace gases has not until lately been regarded as of any value as a guide to their chemical composition. An apparatus based on accurate observations of variations in the refractive index has now, however, been designed by F. Haber and has quite recently been placed upon the market by Carl Zeiss, of Jena. This instrument allows percentage variations down to 0.10 per cent of CO_2 to be easily detected, the refractive index of the furnace gas being compared with that of air, or some other standard gaseous mixture. A difference of one per cent of carbon dioxide makes a difference of 0.0000015 in the refraction coefficient, and this corresponds to 1.1 divisions upon the scale of the instrument.

Further details of this instrument will be given in Article XI.

Color—The color of the gases passing away from the furnace or combustion chamber of a boiler is some guide to the completeness of the combustion process. Gases in which all the carbon has been burnt to CO_2 and the hydrogen to H_2O are colorless and transparent, while incandescent particles of carbon produce yellow tongues of flame, and unconsumed hydrocarbon gases appear as dark streaks upon the bright background of the furnace walls.

It is advisable to use a dark blue glass when examining the furnace gases in this way, and to study first the various phases of combustion, with a bunsen burner-flame held against a cherry-red background of card or paper. By varying the amount of air admission at the base of the burner, all degrees of combustion can be obtained with the hydrocarbon gases supplied to the burner; and in this way an artificial reproduction of the conditions prevailing in a boiler furnace may be obtained. It is unfortunate that the combustion process in the furnaces of the ordinary internally fired Lancashire boilers can not be studied in this way, and that the method is only applicable to the furnace gases from water-tube boilers. In these latter, and in externally fired Lancashire boilers, sight holes closed with sheet mica can easily be made at suitable points in the brickwork setting, and a valuable check upon the combustion process can be exercised by observations made through blue glass, in the manner already described. The observations should be made as far from the boiler furnace as possible, but before the gases come into contact with the water-cooled plates or tubes of the boiler.

3. Sampling the Waste Gases—For regular and systematic control of the work of the boiler plant, it is necessary that frequent tests should be made of the exit gases from each boiler, both for temperature and for chemical composition.

The best place for taking the sample of the gases is at a point about eighteen inches or two feet on the boiler side of the damper which is used to cut off the boiler from the main flue to the economizers or chimney. If Lancashire boilers are installed and a separate damper be provided for each side flue, two sampling holes will be required. The holes should be made large enough to take a thirty-inch length of one-and-three-quarter-inch wrought-iron pipe, provided with a flanged top which can be closed with a bolt or plug when the pipe is not in use. This pipe is set with fireclay in the brickwork setting of the boiler, and is always ready for use when required. When fixing new boilers in position it will save time and trouble if a number of these sampling holes be provided in the brickwork setting at points suitable for testing purposes. Similar holes ought to be provided at one or more places in the main flue, and in the breast of the chimney; since the chemical composition of the waste gases at these points serves to indicate the amount of air leakage through faulty brickwork that is occurring between the boiler and the chimney. The sampling hole on the chimney breast must be made at a height of at least fifteen feet from the ground, as baffle walls are generally provided at the chimney base to direct the gases from opposite flues in an upward direction, and a sample of the mixed gases can not therefore be obtained at a lower level.

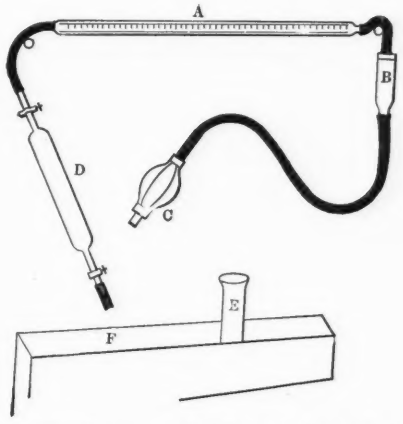


FIG. 33.—HONIGMAN GAS-TESTING APPARATUS.

For withdrawing the sample of gas from the flues, tubes of hard (potash) glass must be employed in three-foot lengths, and of three-eighths-inch external diameter. Arrangements for attempting to sample the gases across the whole width of the flue, by use of a perforated or split wrought-iron tube, are of little use, and it is best to simply insert the hard-glass tube, so that its far end projects about eighteen inches into the flue. A large bung, one and three-quarters inches in diameter, is fixed upon the glass-sampling tube, so that it is firmly held in position in the flanged end of the wrought-iron pipe, and no air leakage into the flue occurs at this point. A second or third length of hard-glass tube is now joined to the first by thick red-rubber tubing of good quality (black rubber is not suited for work with hot gases), and the sampling apparatus is then connected to the free end of the sampling tube or tubes. No filtering arrangement for retaining soot is used at this stage of the sampling, since it is better to have the freest possible passage between the flue and the sampling vessel. Soot and moisture will collect upon the inner walls of the glass tubes, and these must be well washed after each sampling operation, and allowed to drain and dry before use again.

Three methods for collecting the sample will now be described:

(a) *Snap-Samples of the Waste Gases Taken by Aid of the Dry Method and Honigman's Gas-Burette*—Honigman's original gas-burette was designed for testing the amount of carbonic acid present in gas mixtures containing a large percentage of this gas; it has been largely used in the manufacture of sodium bicarbonate and other chemicals. In its earlier form the burette was not well adapted for boiler work, and the form of burette and sampling apparatus has been modified by the writer to render it more suitable for use in testing the waste gases from boiler plants, and also more accurate in its results. This improved form of the Honigman apparatus is shown in Fig. 33. A is the special gas-burette holding about 110 cubic centimetres of gas, and graduated in fifths of a centimetre for the first twenty-five cubic centimetres of its contents. A space of ten cubic centimetres between the zero mark and the end of the burette is essential. C is a rubber finger-pump provided with valves, so that the gases pass through it only in one direction. It passes thirty-five cubic centimetres of

gas at each compression and is employed for "drawing" the sample of waste gases into A from the flue. B is a small rubber stop-valve which is inserted between A and C, to prevent all possibility of air leakage through C back into A. By drawing 600 cubic centimetres of gas through

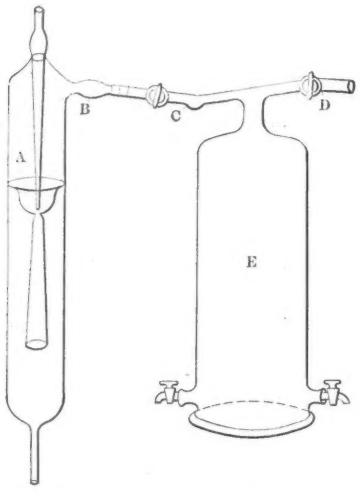


FIG. 34.—SAMPLING APPARATUS FOR AVERAGE SAMPLES.

A all the original air will be displaced by flue-gas. With a finger-pump of the above dimensions this can be effected in seventeen compressions, occupying less than one minute. If a check sample of gas for more complete analysis be collected at the same time in the gas sample tube D, the amount of gas drawn through the apparatus must be increased correspondingly to allow for the increased volume of air requiring displacement.

The glass stop-cocks on D are then closed, the spring clips are placed on the rubber at each end of A, and the sampling apparatus can then be disconnected and the sample taken away for analysis.

Since no liquid is used in this method of collecting gas samples, no absorption of carbonic acid gas can occur before testing. As a general rule the soot will be removed by deposition upon the inner walls of the sampling tubes before the gas arrives in D or A. With very smoke-laden gases, a little glass-wool must be inserted in the rubber tube connecting D to the tubes that pass to the flue to filter out the particles of unconsumed carbon.

(b) *Average Samples Extending Over One Hour*—When an average sample of the waste-gases over a period less than one hour is required, the apparatus shown in Fig. 34 is employed. A is a water-jet air pump which works upon the injector principle, and draws air through the arm B at a rate dependent upon the pressure of the water supply. The arm B is connected to the limb marked C of a Stead gas-sampling bottle, and the other limb of this, D, is connected to the glass tube or tubes leading to the flue. The sampling vessel E is filled up to the point where it joins the horizontal limb with mercury. The pump is now set to work and gas is drawn from the flue at a constant rate through the horizontal limbs, C, D, of the gas sampler. One of the lower cocks of this is now opened to allow a slow trickle of mercury to pass out. A mercury bottle provided with a funnel is placed below, to receive this and store it for the next sampling operation. The rate of flow of the mercury must be arranged so that the sampling bottle will still contain some of the metal at the end of the period over which the sampling is to extend. During this time, gas drawn from the flues will have been passing continuously through C, D, and a small proportion of this gas will have been continuously passing into E to replace the mercury which has flowed away. At the end of the period, therefore, E will contain a fair average sample of the flue-gases, and on closing all the cocks the apparatus can be disconnected and the vessel E containing the gas sample can be taken to the laboratory for chemical examination.

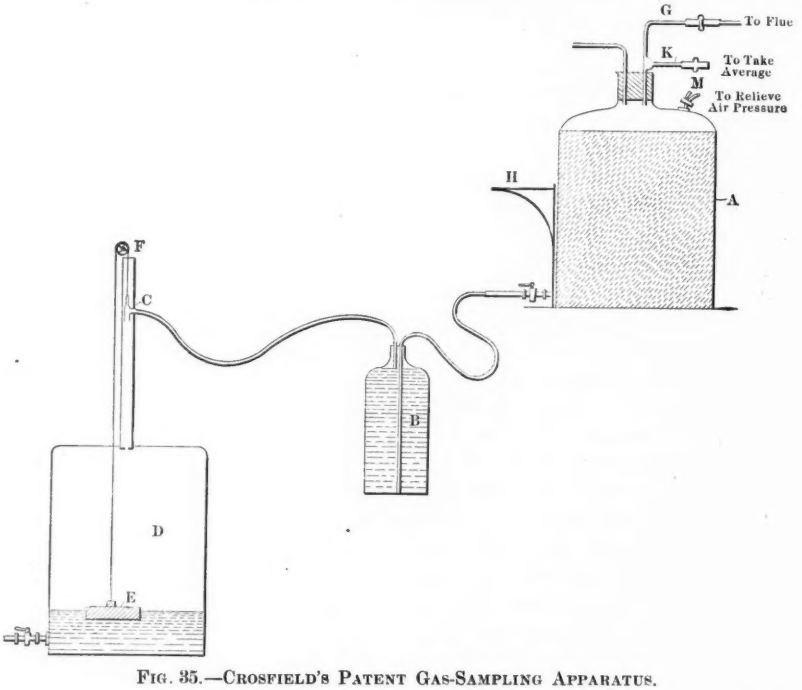


FIG. 35.—CROSFIELD'S PATENT GAS-SAMPLING APPARATUS.

If the waste-gases are very smoky, a small bottle containing glass-wool must be used to filter out the soot, this being inserted between D and the first length of sampling tube. The wool must be renewed for each test, as owing to the large volume of gas passing through the apparatus, a large quantity of soot will soon be collected. The mercury also will require frequent cleaning. This is best carried out by filtering through a large dry filter paper having a pin-hole in the apex, and by then washing the mercury with tap water and drying with filter paper or blotting paper. When quite clean no reaction occurs between the dry flue-gases and the mercury, and the sample can be kept for some hours in the vessel E without change.

(c) *Average Sample Extending Over Twelve Hours*—When an average sample of the flue gases extending over a period longer than one hour is required, the apparatus shown in Fig. 34 can not be employed, for the weight and cost of the mercury required would be prohibitive.

It is then necessary to use an apparatus depending upon the flow of water from one vessel to another and a difficulty arises due to the variation in the head of water at different stages of the sampling operation. The head being greatest when the sampling vessel is quite full of liquid, the outflow of water and inflow of gas will start at a maximum and gradually become reduced as the water is displaced by gas. The sample of gas obtained in this way can not, therefore, be regarded as a true average of the waste gases in the flue during the twelve hours over which it has been collected.

Fig. 35 shows a gas-collecting apparatus in use at Messrs. Crosfield's soap works at Warrington which is free from this defect, the rate of flow from the upper to

the lower vessel being constant for all variations in the water level.

The water from the upper gas collecting vessel A passes through the intermediate water-sealed bottle B, and then into the lower reservoir D by the delivery tube C. This delivery tube falls as the water level in D rises on account of its attachment to the float E by a cord passing over the pulley F.

The head of water is thus seen to depend upon the vertical distance between the level of water in the vessel A and the position of the delivery tube C, and a study of Fig. 35 will show that this is constant for all positions of the water level in A. The gases will thus be drawn into A at a constant rate during the whole of the twelve hours; and the sample, therefore, may be regarded as a true average of the flue gases during this period.

Two precautions must be observed in using this apparatus. The water in A must be covered with a film of oil to prevent CO absorption; and the tube G, leading to the flue, must be connected, not direct to the flue, but to a T-piece as in Fig. 34, through which the gases are being drawn at a rapid rate by the water pump. Otherwise the sample of gases collected in A will hardly be representative of the flue-gases. If only one sampling apparatus be in use, the top vessel is filled by hand when empty. If one apparatus be provided for each boiler of a large battery, a small pump is used for discharging the water from the lower storage vessels into the top vessels, all of these being connected to one water main. It is, of course, necessary that each vessel should be quite filled with water before starting the sampling. For this purpose the air cock at M is opened to allow the imprisoned gas to escape when the vessel is being filled with water.

The apparatus described above has been patented by Messrs. Crosfield, in the name of Crosfield & Dale, English Patent No. 9099, of 1906.

W. H. Blood, Jr., Retained as Insurance Expert by the National Electric Light Association.

W. C. L. Eglin, secretary of the National Electric Light Association, announces that W. H. Blood, Jr., of 84 State street, Boston, Mass., has been retained by the association as insurance expert in the interest of the members. Any member companies having insurance troubles would do well to call upon Mr. Blood for services that will undoubtedly be of great assistance and which will be promptly rendered.

Second Annual Electrical Show at Chicago.

Announcement is made that the second annual show of the Electrical Trades Exposition Company, which will be held at the Coliseum, Chicago, Ill., January 14 to 26, will, according to present indications, far surpass last year's success. Managing Director Homer E. Niesz states that space already sold is greater than that disposed of for the 1906 exhibition, and that a number of the exhibitors have doubled their show space.

The complete list of exhibitors to date is as follows:

Aetna Electric and Stage Lighting Company, Allis-Chalmers Company, American Steel and Wire Company, American Telephone Journal, Armour Institute, Brilliant Electric Company, Bryant Zinc Company, W. J. Burns, Central Electric Company, Central Electric Manufacturing Company, Chicago Battery Company, Chicago Edison Company, Chicago Lamp and Reflector Company, Chicago Pneumatic Tool Company, Chicago Telephone and Telegraph Company, Commonwealth Company, Frank B. Cook, Crane Company, W. P. Crockett Company, Diehl Manufacturing Company, Dixon Crucible Company, Duncan Electric Manufacturing Company, Edwards Electric Headlight Company, ELECTRICAL REVIEW, *Electrical World*, Electric Appliance Company, Electric Rotary Floor Polisher Company, Electric Service Supplies Company, Electric Storage Battery Company, Electrocraft Publishing Company, *Engineer* Publishing Company, Erwin & Company, Federal Electric Company, Fort Wayne Electric Works, General Electric Company, Gould Storage Battery Company, Emil Grubbe, M.D., Guarantee Electric Company, J. Allen Haines, Haller Machine Company, Holcombe & Company, Holtzer-Cabot Company, H. W. Johns-Manville Company, Kellogg Switchboard and Supply Company, J. Lang Electric Company, Mathews & Company, Metropolitan Electric Supply Company, Monarch Electric and Wire Company, National Battery Company, National Carbon Company, Niagara Tachometer and Instrument Company, Oliver Manufacturing Company, Ohio Brass Company, Peabody Coal Company, Peterson Manufacturing Company, Phoenix Glass Company, Reynolds-Dull Flasher Company, Rock Island Battery Company, Roth Brothers & Company, W. H. Schott, J. S. Schureman, Shelton Electric Company, Simplex Electric Heating Company, Stanley-G. I. Electric Manufacturing Company, Sterling Electric Company, Stolz Electrophone Company, Stromberg-Carlson Telephone Manufacturing Company, Swedish-American Telephone Company, Telephony Publishing Company, The Consumers' Company, Universal Electric Storage Battery Company, Vesta Accumulator Company, Vim Company, Vulcan Electric Heating Company, Wagner Electric Manufacturing Company, Western Electric Company, *Western Electrician*, Westinghouse Electric and Manufacturing Company.

Changes in the Personnel of the Engineering Staff of the New York Central & Hudson River Railroad.

The following announcement of changes in the engineering staff of the New York Central & Hudson River Railroad has been made by W. J. Wilgus, vice-president:

Edwin B. Katte is appointed chief engineer of electric traction. George A. Harwood is appointed chief engineer of electric-zone improvements, exclusive of electric traction and signals. George A. Berry, having resigned to accept another position, the department of company forces will hereafter report to the chief engineer of electric-zone improvements. John D. Keiley is appointed electrical engineer. Carl Schwartz is appointed engineer of power stations.

W. H. Knowlton, principal assistant engineer, will have direct charge of all contract construction work and right of way matters from the south bank of the Harlem river to Peekskill and North White Plains; resident engineers in this territory will report to him. J. L. Holst is appointed engineer of structures. He will have charge of the design and erection of all steel in the electric zone, excepting erection in the Grand Central terminal; the design of all buildings not in charge of the associated architects, and the design of all masonry and miscellaneous structures north of the south bank of the Harlem river; the assistant bridge engineers, assistant designing engineer in charge of structures north of the Harlem river, architect, cement tester and driller will report to him. W. F. Jordan is appointed terminal engineer; he will have charge of the design and construction of the Grand Central terminal and other work in connection with the electric-zone improvements south of the south bank of the Harlem river, except the structural-steel design and the Grand Central station and other work in charge of the associated architects. The resident engineer and assistant designing engineer within this territory will report to him. L. H. Byam is appointed engineer of company forces.

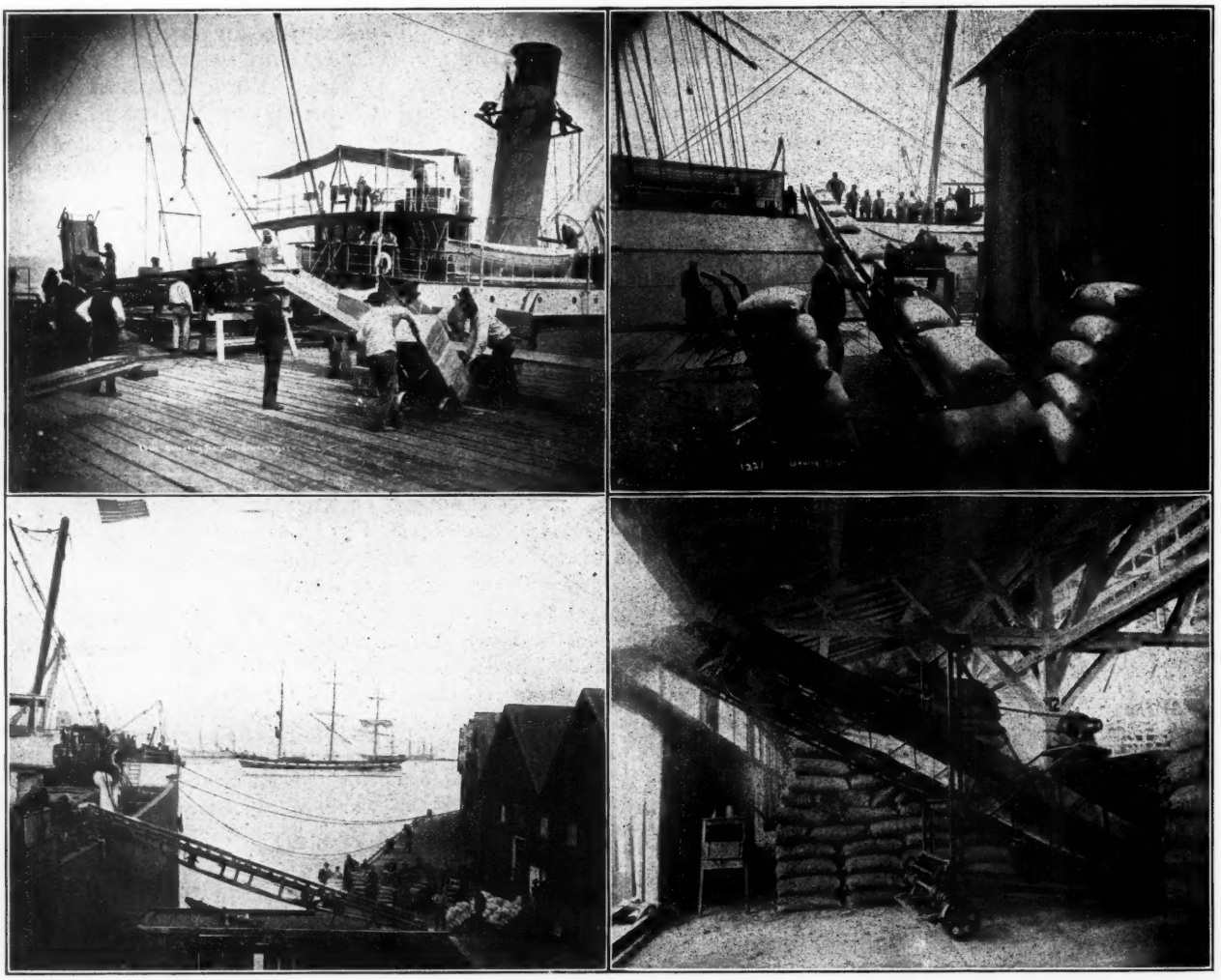
Adaptations of Electrically Driven Conveyers.

By Day Allen Willey.

THE applications of electricity for conveying material are diversified, and some of the apparatus which has been designed for this purpose is very elaborate in character. Where the current can be generated at a moderate cost, it has been shown that the electrically operated conveyer is, in many instances, far more economical and more effective than that driven by steam or other power.

A notable illustration of this kind is given in the method employed for transferring cargoes of vessels at Tacoma, Wash. It may be needless to say that this city is one of the principal shipping ports on the Pacific coast. It exports a large amount of grain as well as flour and lumber, while the merchandise imported includes tea and other Oriental products. The wharf at Tacoma is no less than 13,000 feet in length, lined with warehouses which include some of the largest structures of the kind in the world. The harbor is not provided with piers extending parallel with each other so that the steamships and sailing craft are moored to this one long wharf, one ahead of the other. If steam power or manual labor were employed for loading and unloading cargoes the outlay would be very large, to say nothing of the time required, since many of the vessels have a cargo-carrying capacity ranging from 5,000 to 8,000 tons.

Fortunately, the electric current is available for this purpose and it is employed almost exclusively in carrying merchandise to and from the wharf warehouses. The system utilized is that of the freight gangway. Enough of these have been constructed to serve each warehouse adequately. The gangways are mounted upon trucks which not only move upon wheels resting on the floor of the building, but extend to beams passing through the upper portions, thus aiding in steadying the gangway and preventing it from falling over when loaded. During the times when they are not in use the gangways are rolled back into the warehouses. When required for service it is only necessary to push them to the doorways, when they can be run out and extended over the deck of the vessel. Most of them are equipped with arms or aprons which reach to a point above the hatchways, so that as the cargo to be unloaded is lifted from



Scenes on the Long Wharf at Tacoma, Wash.—Electrically Driven Conveyers at Work Unloading and Warehousing Ships' Cargoes.

the hatch by the boom derricks of the ship, it can be lowered directly upon the outer end of the gangway and transferred to the warehouse.

The upper portion of each gangway is composed of an endless belt which is supported upon a series of metal rollers and passes around larger ones mounted at each end of the structure. Attached to the side of the gangway and connected with a shaft driving one of the end rollers is a flywheel. Around this passes a belt which is attached to another shaft directly connected to the actuating mechanism. This is a motor developing twenty-five horse-power, so mounted that it can be adjusted to the outer or inner end of the conveyer as may be desired. As the photographs show, it is usually placed above the gangway for convenience. The motors employed are intended to take a two-phase current which is transformed to low tension of a voltage adjusted to the service to be performed.

It is an interesting fact that the current is obtained from the Puyallup river, one of the glacial water courses which have their origin on Mount Tacoma or Rainier. The generating station is located at a point on the river thirty-two miles distant from the city.

Although the maximum energy required to operate this electrically driven apparatus is but twenty-five horse-power to each one, the series in service perform the labor of over 1,000 men, so that the only force required is a man to operate the electric switch controlling each motor, the loading and unloading squad in the hold of the vessel and the force necessary to stow away the merchandise in the warehouses. A further idea of the service required can be gained when it is stated that this wharf contains no less than five warehouses and elevators which are used for wheat and flour alone, one of the warehouses being nearly 2,400 feet in length and the longest grain warehouse in the world. In addition to the regular steamship lines a fleet of "tramp" steamships and sailing vessels ply between Tacoma and other Pacific ports, so that in a year from 125 to 150 vessels are loaded with wheat alone, saying nothing of other cargo. At one time a dozen cargo-carriers, ranging from 4,000 to 8,000 tons, may be seen at the docks, yet with the entire conveying system in operation not over twenty men are necessary to each vessel and the warehouse from which it is receiving or to which it is transferring cargo.

The breadstuffs exported are usually loaded in bags and so rapidly does one of these electric gangways work that as fast as the receptacles can be trundled to the receiving end they are conveyed on shipboard, while the tea and other commodities unloaded are delivered on the wharf or into the warehouses as fast as the stevedores can handle the packages.

Electric Lighting by Wind Power.

The possibility of making wider use of wind power for electric lighting has been discussed in some detail by E. L. Burne. It is pointed out that the minimum speed of the wind in England is seven and one-half miles an hour; that for approximately one-half the time the velocity is not less than ten miles an hour, and under favorable conditions a speed of fifteen miles and over may be expected for about one-third of the time. During the winter months the averages are about fifteen per cent higher, and in open places, such as the seacoast, these rates are exceeded. The drawback to wind power is that the breezy periods do not succeed each other at regular intervals, and calms lasting from three days to a week must be provided against. Indeed, the latter period is sometimes exceeded. The velocity of the wind at 100 feet from the ground is twenty per cent greater than at fifty feet, and ten per cent less than the latter at twenty-five feet, so that apart from the necessity of being clear of all obstructions to the full flow of the wind a good elevation is desirable for a windmill. Theoretically, the power of the windmill varies as the cube of the velocity, though in practice it is subject to some modification. The limits of useful wind velocity for power purposes may be taken as from ten miles up to twenty, or possibly twenty-five as the upper limit. Of the two types of windmill, the disc and the sweep types, the latter type has the advantage of a higher efficiency per unit of surface and a higher velocity. However, there is but little practical knowledge concerning the latter type. P. La Cour, investigating for the Danish government, found that the best results were obtained from a mill having four approximately rectangular sails, the breadth of which should be from one-fourth to one-fifth the radius of the arm, and the length from three-quarters to four-fifths of the same. The details of construction which bring the wheel up to the wind and which prevent excessive speeds are given at some length, and it is suggested that a centrifugal governor might be employed with advantage. Various methods of obtaining constant speed are dwelt upon. One of these, employed in a mill in operation at Askov, Denmark, depends upon a variation in belt tension which causes the latter to slip on the dynamo pulley. Some particulars are given of a windmill erected in 1897 which has been driving a dynamo since that time. The span of the four sweeps of this mill is seventy-five feet, and the breadth is eight and one-half feet. The mill is provided with two dynamos, one delivering 250 amperes at twenty-eight volts for electrolyzing water, and one forty amperes at 150 volts for charging a storage battery. There are 450 incandescent lamps connected to the battery. A gasolene motor has been added to this equipment as a precaution against calms. The total cost of installation was $4,365. The annual cost of operation is made up as follows:

Attendance for oiling and starting the mill	$55.00
Attendance to the gasolene engine	33.75
Thirty days' consumption of gasolene	55.00
Lubrication	22.50
Making a total of	$166.25

The receipts from the sale of electrical energy during this time amounted to $700, so that the excess of receipts over expenditures amounted to twelve per cent of the capital outlay. Another installation described briefly is at Boyle Hall, West Ardsley, Yorks, England. This wheel is thirty feet in diameter and has fifty hinged vanes, each ten feet long. It drives a dynamo through bevelled gearing and a belt. The battery maintains charged sixty storage cells with a capacity of 490 ampere-hours, a supply sufficient for eight days. This battery supplies 109 incandescent lamps, of which twenty are eight candle-power and the remainder sixteen candle-power. The plant has been in operation since 1899. The total cost was $6,000. The running expenses are $150 per year, or adding four per cent for interest on the installation $390 per year.—*Electrical Review (London), October* 19.

The Rejuvenated Sons of Jove.

A Jovian lunch club was formed in Boston, Mass., on October 31, for the purpose of meeting at lunch each Wednesday noon. The committee of arrangements consisted of Frank Booth, S. B. Condit, W. F. Hessel and Albert Mann. Twenty-six members of the Sons of Jove became members of the lunch club.

A rejuvenation will be held on December 7, under the auspices of Frank Booth, No. 395, Jovian statesman.

English Electrical Notes.

(By Our London Correspondent.)

THE troubles of Willans & Robinson, Limited, once of Thames-Ditton, and now of Rugby, and alas! Queen's Ferry also, are fairly common knowledge now throughout all industrial quarters of the globe. So far as Queen's Ferry and the steel works enterprise was concerned, a mistake was committed for which blame has been generously allotted, but the other causes of failure are those which call rather for sympathy than criticism. For years the company had things very much its own way with the Willans engine and "coined" money, but that period of success came to an abrupt conclusion when other prime movers came along with more fascinating qualities which seduced the central station engineer away from his old love. The company, when it thought it saw the trend of things, entered into more or less active agreement with its adversaries. The manufacture of the large gas engine was taken up "as a matter of prudence," because it threatened to supplant the large reciprocating steam engine. A good deal of capital was expended and some gas-driven stations were equipped, but it is now confessed that there is no hope in this direction, for large gas engines "are very difficult to make and to get any profit out of at all." Indeed there has been considerable loss and the whole of the expenditure on the department is to be written off. Reading between the lines, the making of large gas engines at Rugby is to be abandoned.

The steam turbine (Willans-Parsons with Captain Sankey's system of blading) is greatly in favor in England and will, if present indications can be relied on at all, do more than anything else to give the needed fresh life to the concern. The Diesel oil engine is another direction in which the company is energetically working. By means of these, in course of time, Willans & Robinson, Limited, of Rugby, may, when it has been relieved of its Queen's Ferry steel works incubus, once more be able to stand erect. But there are matters of financial re-arrangement to be faced before then. Meanwhile the company is with us to-day as one of the effects of latter-day development and evolution in power-station prime movers—a progress which seemed to come so suddenly that it was not prepared to meet it.

A young butcher, aged twenty-one, has just met his death at Derby, under circumstances which have led eminent electrical experts who have investigated the matter to change their minds and to admit the necessity for earthing electric fans under certain circumstances. The victim, one Allsopp, while his hands and boots were saturated with brine, switched on an electric fan (200 volts) in a cellar where brine was used for pickling pork. When the fan was examined after the accident, a distinct shock of varying intensity was experienced, according to the position of the switch handle. The fan was in perfect order save for this leakage, and this leakage, in the opinion of the city electrical engineer, T. P. Wilmshurst, was due to the action of brine which had been spilt or splashed on the fan and had permeated the working parts. J. F. C. Snell, a well-known electrical expert, attributed the fatal result, with such a low voltage, to the coincidence of a number of favorable causes, the hands and feet being saturated with brine, the cellar damp, the wetness between the switch handle and the casing of the fan, and the action of the deceased in grasping the standard instead of the switch, and being unable to let go. Now, 250 volts is English regulation low pressure, and so far there are no regulations requiring special protection below that. Mr. Wilmshurst, as a result of the case, is inclined to recommend certain precautions though there is considerable difficulty in earthing these portable fans. Mr. Snell confesses that before this fatality he would not have dreamed of suggesting the earthing of such fans. He has now changed his mind.

Manchester has a very extensive municipal system of electric trolley lines. For some time past, too, private parties have been running motor-omnibuses, but these have been creating so great a nuisance from noise and smell that the chief constable and city surveyor condemned them as unsuitable for Manchester's thoroughfares. It is now proposed to refuse renewal of the licenses. The statements made in connection with the Manchester inquiry, as well as the experience now being obtained in London with motor-busses, point very plainly to the excellent reception that awaits the electrical omnibus with its smooth running and freedom from exhaust and offensive smell.

Regarding Manchester's tramways, the efforts of the corporation to compete with private carriers of goods and parcels have been a complete failure. After spending large sums of money setting up the department and organizing a system for horses and vans to deliver goods from the tramway termini, and also after indulging in costly litigation with the private carriers whose interests were unwarrantably attacked, the corporation is going to abolish a very large part of the undertaking. This is a fair example of the way some English municipalities have been spending public money in competition with their own rate payers, nobody, save perhaps the lawyers, being any the better, and many, particularly the affected industries or trades, being considerably the worse off for the transactions.

Electricity supply authorities in England, when they have wanted to change over their supply to consumers from 100 and 110 volts to 200 and 220 volts, have frequently had to contend with considerable hostility from customers who have had a suspicion that they are to bear all the inconvenience of the change, while the supply authority obtains the sole benefit. In most cases the cost of change-over has been borne by the authority, and in this and other ways the consumer has been pacified. But there are districts in which the cooperation of a few consumers in the matter has been withheld, and these few have had to be specially supplied at the old low pressure, while the great bulk fell in with the supply suggestions. A case of this description has just been before the courts. The Marylebone Borough council took over, last year, the supply business of the Metropolitan Electric Company, in its area. At great cost a turbine power-station was put down from which supply is being now obtained, and as part of the scheme it was planned to give a 240-volt supply to the whole of the 6,000 consumers. Previously, however, there had been a variety of voltages in vogue, some as low as fifty volts, and some of the old consumers who had taken energy from the company for ten years or more had the right to oppose the change-over. One large consumer, Map-

pin & Webb, of Oxford street, declined to accept the alteration, and for the time being the Marylebone council, having no alternative, agreed to continue the 100-volt supply; for though they had secured the Board of Trade's consent to the higher pressure, they could not effect an entrance to make the necessary alterations without the permission of the consumer. It was because they did not wish to act in a high-handed manner that the Marylebone council temporarily continued the lower pressure, but the ground for the action was that the council did not continue to maintain the pressure at the agreed 100. Indeed on a number of days it fell to ninety-four and even eighty-four volts, causing considerable inconvenience; oil lamps and candles having to be requisitioned to enable business to continue. The magistrate has fined the council heavily for its failure to maintain efficiently the supply agreed upon, but there are indications that the matter will be carried to a higher court.

The generating station at Marylebone is the very latest example of central station practice in London. Arthur Wright is the consulting engineer. Briefly stated, it is a direct-current supply without substations, and the first installment of plant put in consisted of Babcock & Wilcox boilers with chain-grate stokers and superheaters, four 500-kilowatt Parsons turbo-generators running at 240 volts, and four 2,000-kilowatt turbo-generators generating at 480 volts. Each set consists of two dynamos coupled to a steam turbine, the smaller dynamos acting as balancers. The cooling towers are placed above the boiler house.

The city of Oxford, after prolonged deliberations and years of delays, has now definitely approved of the change-over of its tramways from horse traction to electric. At one time it seemed very much as though in the future tramways would be barred altogether and motor-busses be substituted. The overhead trolley system the city will not have on any account, so it has approved of the conversion of the existing system to the Dolter surface stud-contact system. This particular principle has been recently applied to the tramways of Torquay, Mexborough and Hastings, but these are not yet quite completed. The only other examples of surface contact tramway to be found in England so far as the Lorain system which has been running for many years now at Wolverhampton, and the G. B. system which is operating at Lincoln.

Considerable progress is reported from Poplar in connection with the municipal scheme for supplying cheap disinfectant by means of the electrolytic hypochlorite plant installed by Dr. F. W. Alexander. The system is now established on a permanent basis and an offer of free supply to workhouses, asylums and schools in the district has been made.

The vacation of the scientific and engineering institutions is now at an end, and with many of them meetings are about to commence for the new session. The Civil and Mechanical Engineers' Society is the first to set the ball rolling, for on October 4 the presidential address was read by W. B. Esson, an eminent electrical engineer who took for his subject the "Industrial Power Problem," dealing with the production and distribution of power at the lowest cost, in the light of the present position of power affairs in England. He contended that electricity as a means of distributing power had no competitor, though efforts had been recently made to distribute fuel (not power) in the form of Mond gas, which might suit the requirements of some manufacturers better than power delivered electrically. A proposal that has been put forward for distributing fuel gas in Cumberland was touched upon. With power-houses erected at Maryport, Workington and Cleaton Moor, it is proposed to utilize the waste gases from the three greatest ironworks, part of the gas being used in engines for generating electricity and the remainder distributed. According to estimates gas representing 60,000 horse-power is being wasted continuously from these furnaces alone.

During November the Institution of Electrical Engineers will resume its meetings in London and at its half-dozen local sections. Dr. R. T. Glazebrook will deliver his presidential address at the opening London gathering.

Birmingham, though it has made such excellent progress in so many ways in public improvement work, has been somewhat backward in electrical development until the last year or so. This applies to both lighting and tramways, but particularly to the latter. Yet Birmingham was the scene of some of the earliest British work in both departments of electrical engineering. Some six years ago the municipality bought over the old company's light and power system and it has now opened a big generating station which forms part of a development scheme which was put in hand some little time ago under the supervision of R. A. Chattock, the city electrical engineer. The new scheme includes the generating of both direct and alternating current at Summer's Lane station, with transmission of the alternating current at high pressure to a series of substations for local distribution in the form of direct current. In the station the high-tension alternating and the direct-current plants and their respective switchboards are kept separate on opposite sides of the building. When the present plans are completed there will be installed 13,000 kilowatts of direct-current equipment and 13,500 kilowatts alternating. Four of the direct-current sets now in position consist of Belliss enclosed steam engines driving 1,500-kilowatt Dick-Kerr generators which will supply current for either lighting or traction. There are also two 500-kilowatt Parsons turbo-generators for direct current. The alternating-current equipment comprises Belliss steam engines driving British Westinghouse alternators. The alternators have fixed armatures and rotating fields, and two small 100-kilowatt steam-driven sets serve to energize the fields. The switch-gear part of the installation, both direct and alternating, was the work of the British Thomson-Houston Company. Babcock water-tube boilers are installed, the first section consisting of ten. The Westinghouse 300-kilowatt rotary converters which do service in the substation are fed through banks of single-phase transformers.

ALBERT W. BRIDGE.

London, England, October 27.

New York State Telephone Developments.

The United Message Company, of Albany, N. Y., has acquired the Commercial Union Telephone Company, of Troy, N. Y., operating in Troy, Glens Falls, Saratoga and about twenty other towns in New York state. This is in line with the work of taking over all the independent telephone interests in the state as fast as they can be acquired. The corporation has a working capital of $35,000,000. Judge Hendrickson, recorder of the city of Albany, is president of the United Message Company.

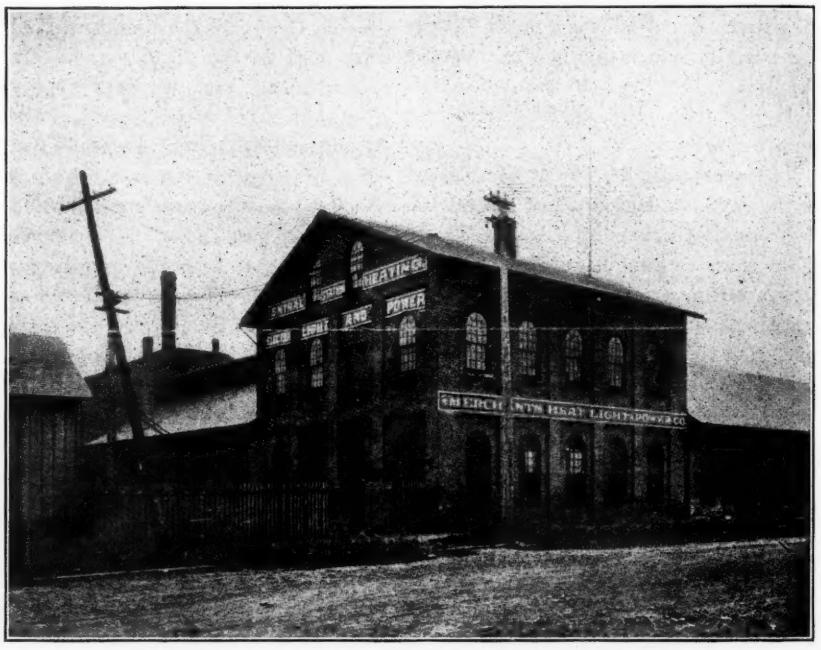
A Combined Heating and Lighting System at Canton, Ohio.

By R. W. Hutchinson, Jr.

WITHIN the last few years there have sprung up in the Middle West a number of combined heating and lighting systems which in many cases have become strong competitors of the more customary "isolated plant" style of heating, as well as the competitors of the natural-gas companies. A plant which stands out prominently as an example of the splendid opportunities in a combined heating and lighting system for even comparatively small companies when ably managed is that of the Merchants' Heat, Light and Power Company, of Canton, Ohio. The beautiful, healthy and progressive little city of Canton, with a population of upwards of 40,000, was from both a technical and commercial viewpoint, a particularly favorable point for the location of such a plant. An insufficiency of water rendered a condensing plant impracticable, hence the use of exhaust steam for city heating affords economies and conveniences to the consumer and makes at the same time a profitable venture for a company which can well invite the attention of other companies similarly situated. The company began business in April, 1905, as the successor of the Citizens' Heat and Light Company, which was organized primarily to supply heat and light to a superb new hotel. The hotel company became insolvent and the newly formed company acquired its franchise for a new heating line through the principal portions of the town. During the past year it has constructed a system under all the central section of the city and has additional franchises for five miles of street.

The power station is rectangular in shape with a peaked asbestos-covered roof supported on steel trusses. Both engine and boiler room have separate peaked roofs. The size of the engine room is forty-three feet by sixty-five feet; the boiler room measures forty-one feet by sixty-five feet. The engine room is equipped with a crane with a track resting on pilasters; the engine-room floor is of concrete supported on a steel frame resting on piers. The concrete is five inches thick and is laid on corrugated iron plates made by the Berger Manufacturing Company, of Canton. Such a construction makes a floor of highest rigidity and bearing power and was rendered necessary in this case by the soft ground on which the station was built.

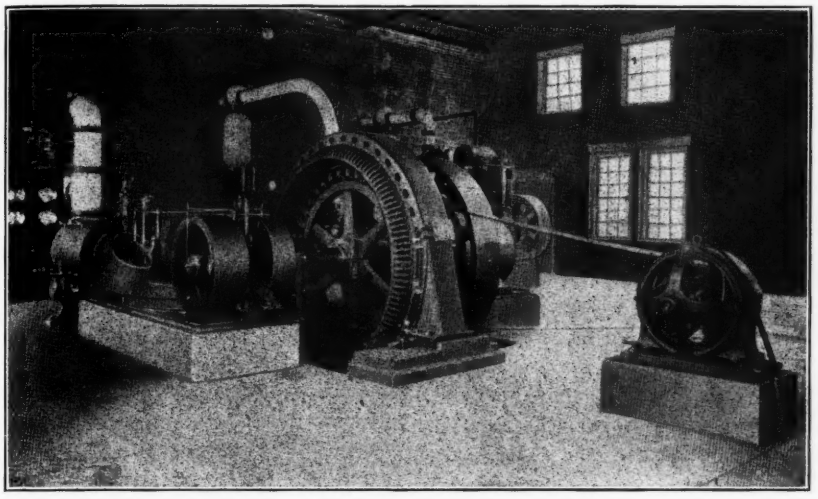
The boiler equipment consists of three 250-horse-power Sterling water-tube boilers fitted with Roney stokers and arranged in a battery and a half with provision for an additional unit. The grates of the furnace receive their draught from a self-supporting steel stack, resting on concrete fourteen feet thick. The stack is seventy-two inches in diameter and 150 feet in height. The boilers are fed by two boiler pumps immediately in their rear; on the side are two low-duty pumps for pumping from a 2,000-gallon tank supported on a platform near the roof of the boiler room. Two vacuum and one receiver pump are placed below the engine floor. All of this pumping apparatus is in duplicate and was made by the Canton Pump Company. The engine equipment comprises two Russell cross-compound non-condensing engines, each of 375-horse-power capacity at 200 revolutions per minute. The engines are kept supplied with oil by a gravity oiling system; the oil tanks are located on the wall, the oil circulating by gravity, is caught in a receptacle below the engine floor and then pumped back into the tanks. The "Cross system" of filtering is employed. Each engine is direct-connected to a National 250-kilowatt, two-phase, 2,300-volt alternator made by the National Brake and Electric Company, of Milwaukee, Wis. The power-generating equipment is arranged parallel to the walls of the station, with ample space between the units to insure plenty of heat-radiating surface. The units are of symmetrical lines and of fine operating characteristics. The exciting current for the alternators is furnished by two 110-volt direct-current generators, belt-driven from the engine shaft. An additional seventy-five-kilowatt Lundell 250-volt direct-current generator is belted to one of the engines and is employed to supply current to the power load during periods of light load. The power load is carried during hours of heavy load by a 125-kilowatt, 125-volt, direct-current Westinghouse generator, which is belted to a Westinghouse vertical compound engine developing 160 horse-power at 295 revolutions per minute. The switchboard is in gray marble and is installed near the lengthwise wall. It comprises five panels, two of which are the alternator panels; each alternator panel has mounted thereon two 120-ampere ammeters, synchronous plugs and rheostat. The exciter panel has two direct-current ammeters, two rheostats and one field switch and two armature switches. The distributing panel has mounted on it two 300-ampere ammeters, one 140-volt voltmeter, a synchroscope, two oil switches rated at 200 amperes and 3,300 volts. The power panel is equipped with two direct-current ammeters, each of 450 amperes capacity, two rheostats, two circuit-breakers, one double-pole, double-



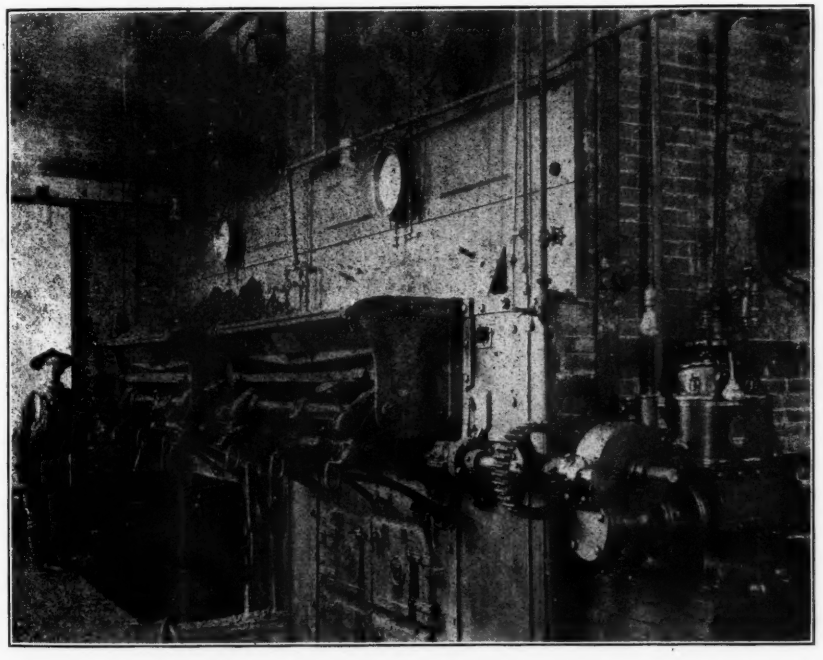
Power Plant and Central Heating Station.

throw switch and an integrating watt-meter of 100-kilowatts capacity.

The exhaust from the low-pressure cylinders of the engines is received by an eight-inch and ten-inch main, which conduct it to a sixteen-inch heating main; this heating main is encased in Wykoff covering, which consists of a tube of tin adjoining the pipe. A layer of sheet asbestos is then served to the pipe, which gives a non-conducting air space, then strips of wood, seven-eighths inch thick, are dovetailed together and encircle the asbestos. These strips are then wound with piano wire and a layer of felt paper, which is asphalted, is applied, then another similar layer of felt paper, asphalted, is applied, another cover of wood strips is placed around this and the completed pipe, which is as practically heat insulating as can be made, is asphalted and rolled well in sawdust. The overall diameter of the sixteen-inch pipe is twenty-three and one-quarter inches. The underground steam main extends about five miles throughout the main business portion of the city and a number of the principal residence streets. It is graduated in diameter in proportion to the square feet of heating surface in various sections of the city. The sixteen-inch main extends to the centre of the city with fourteen-inch pipes running north and south through the down-town part of the city. In the main residence district ten-inch and twelve-inch mains are used, which are tapered down to two and one-half inches in outlying districts. The return steam line is four inches in diameter and is laid immediately under the mains. In addition to the gas and water mains, telephone wires and lighting circuits of other companies being underground, the majority of streets are rather narrow, so the difficulties which confronted the company in laying steam mains were numerous, and frequently costly expedients had to be adopted.



View of One of Main Generating Units.



Main Battery of Boilers Showing Stokers and Stoker Engine.

The exhaust steam is first passed through an oil-separator under the floor of the engine room and then goes through an automatic controller valve set for three to five pounds pressure as an average, but the setting is varied with the load up to ten pounds as a maximum. The exhaust steam is utilized first, but on heavy heating loads, live steam from the single boiler is used. A six-inch live-steam pipe line extends from the boilers alongside the heating system and is equipped with an automatic reducing valve, which is so set that if the pressure of exhaust steam falls below four pounds, live steam will be admitted from the "booster pipe" to the main heating line. The returning steam and condensed water is conducted in a 1,000-horse-power Cookson feed-water heater installed in the engine room. Extra exhaust steam from the engines is also led into this heater.

The customers' rooms to be heated are each furnished with a Powers thermostatic temperature-control valve, with a range of from sixty degrees to eighty degrees Fahrenheit; these valves operate automatically without any attention whatsoever and have been found not to vary over two degrees from five degrees below zero to thirty-four degrees above. The valves are controlled by a one-quarter-inch galvanized-pipe air line running alongside the steam mains; the pressure in this line is fifteen pounds and is maintained by a nine-and-one-half-by-nine-and-one-half-inch Westinghouse air-pump.

The manholes for getting at the underground system are located midway of every block and at every intersection of streets, and are situated about 130 feet apart. The standard manholes are six feet square inside and seven feet deep, to give ample room for working in them; they are lined with brick up to fourteen inches of the top and have a concrete bottom. The manhole covers are of cast iron, resting on rectangular cast-iron frames made of seven-inch I beams. The covers are cast with square flanges; they are thirty-six

inches in diameter and will support ten-ton steam rollers; they are fastened by lugs instead of hinges.

The main steam line is equipped with a bronze expansion joint at every manhole and the return steam line with a similar expansion joint at every other manhole. The manholes are fitted with a trap to drain into a returning steam line, with the vacuum pumps assisting. All of the steam piping is screwed together, which makes the heat insulation continuous from manhole to manhole. The lined pipe has an extra heavy recessed coupling, and every section of the insulated pipe is tested with fifty pounds pressure for ten minutes without showing any drop.

The lighting cables are laid, eight in multiple, in vitrified clay ducts encased in a four-inch bed of concrete. The conduits are supported above the steam line between manholes and are carried around the sides at manholes, which makes them easily accessible. The five ducts were put in to provide for future increase in feeder systems in the business section. The high-voltage feeders consist of No. 2 and No. 4 lead-covered wire. The low-pressure feeders are copper cables of 500,000 circular mils, rubber-insulated and paper-covered. From the south side of Eighth street to the north side of Fourth street and from the east side of Walnut street to Cleveland avenue all wiring is underground. The company is now devoting its efforts toward increasing the lighting load, so that the already profitable heating load can be added to with a low cost for given amount of heating capacity, by doing away with the expense of firing boilers and supplying live steam. The lighting load is about seventy-two amperes and is largely composed of Nernst lamps operating on a 230-volt circuit and taking eighty-eight watts per glower. They are kept in operating shape by the company. The power load is mainly distributed among small motors, electric flat-irons and signs. The charge for current is ten cents per kilowatt-hour for a one-hour connected load and six cents per kilowatt-hour in excess of this time.

The terms of franchise granted the company allow a charge of thirty-five cents per square foot of radiating surface for seven months' service, or sixty cents per 1,000 feet of water by condensation, measured by a meter. A competing gas company selling gas at thirty cents for heating induced the company to fix its rate at thirty-one and one-half cents per square foot of heating surface or sixty cents by the meter plan stated above. The heating system was designed for capacity of 250,000 square feet at a velocity of 250 feet per second. At present the connecting heating load is 100,000 square feet with provision for increasing to 500,000 square feet. The so-called "2-20-200" formula is applied to determine radiating surface and a seventy-degree temperature at ten degrees below zero is guaranteed.

The personnel of the Merchants' Heat, Light and Power Company is made up of prominent business and technical men of Canton. The president is Thos. F. Turner; vice-president, John Rommely; secretary, Barrett F. Steiner; treasurer and general manager, William Stolzenbach, and B. J. Shockley, a practical lighting engineer, is superintendent and assistant general manager. The plant and system was designed and its construction supervised by E. R. Vincent, consulting engineer, of Indianapolis, with C. C. McLain associated with Mr. Vincent as resident engineer. The writer is indebted to the latter for much of the information herein given. The plant was constructed by the Arbuckle-Ryan Company, of Toledo, Ohio, a well-known contracting firm in this section.

A Prayer to the Wiremen.

The following is a copy of several clever paragraphs which have been addressed to the wire manufacturers of the country by S. A. Hobson, vice-president of the Hobson Electric Company, Dallas, Tex. Along with contractors and supply men all over the country, Mr. Hobson has found it difficult at times to get prompt shipments, owing to the tremendous demand for material.

"We beseech thee, oh mighty Factory! ruling Potentate of the commercial world, to bend thy head and open thine ear, to our humble pleading; for relief from the persecutions of our indignant customers.

"We realize, oh Factory! that we are but thy humble servant, and that our daily acts should but please thy fancy. We further realize that we stand in danger of thy condemnation for having secured so many orders, but we feel that you should overlook our breach of discipline, because we acquired our order-getting habit during the days of thy reign when thou didst command that we send thee more business.

"This was during the great order famine when thy power was endangered.

"We were faithful then and didst have thy approbation and encouragement, but now that thou hast reached the zenith of thy power and glory, it darkens our hearts to feel that thou has abandoned us to the mercy of our clamoring customers.

"Now, oh Factory, we pray thee to "set up and take notice" of our deplorable conditions, and grant us the blessings of a little bit better deliveries of our prayers for some of thy products, which we have hoped for during the past several moons.

"Now, oh mighty producer, if thou wilt but answer our prayer, we will grant to thee all the glory and will shout glad hosannah throughout the land."

ANNUAL REPORT OF THE WESTERN UNION TELEGRAPH COMPANY.

FOR THE YEAR ENDING JUNE 30, 1906.

The annual report of the Western Union shows a substantial addition to gross revenue but a large increase in the expenses, resulting in a decrease in the net. The surplus for the stock was equal to 5.89 per cent as compared with six per cent in the previous year.

The exceptionally large increase in expenses is the unfavorable feature of the 1906 report. The increasing expense of the business, combined with the slow development in earnings has been responsible for the poor showing of the last few years.

The almost stationary position of the gross earnings is shown by the following comparison of the gross per mile of wire operated:

Fiscal Year.	Miles of Wire.	Receipts.
1903	1,089,212	$29,167,686.80
1904	1,155,405	29,249,390.44
1905	1,184,557	29,033,635.04
1906	1,256,147	30,675,654.53

During this period the issue of capital for construction purposes amounted to $4,000,000, the remainder of the three-and-one-half-per-cent real-estate bonds authorized in 1900. In addition, over $2,000,000 was expended for construction out of working capital, leaving a floating debt of about $600,000 on June 30, 1906.

The reduction in earnings per mile is partly the result of the addition in mileage which has not developed as large an earning power as the old mileage, located in larger centres of population. It is also due in large part to the inroads made by competition.

The number of messages and receipts and expenses per message compare as follows:

Fiscal Year.	Messages.	Av. Tolls per Message.	Av. Cost to Company of Message
1903	69,790,866	31.4 cents	25.6 cents
1904	67,903,973	31.7 "	26.1 "
1905	67,477,320	31.6 "	27.3 "
1906	71,487,082	31.6 "	27.6 "

As the cost per message shown does not include the expenditures for maintenance and reconstruction, it will be seen that the increase has been in actual expenses of operation. Higher wages and competition are stated to be responsible.

The report states that the expenditures for maintenance include betterment work which might with propriety have been charged to capital. It is of interest to note, however, that the maintenance absorbs only fourteen per cent of the gross.

The expenditures for new construction during the year were $3,292,981.

The Growth of the Westinghouse Interests.

From the *Boston News Bureau*, October 27.

It is not an easy problem to present without the aid of photography the growth of the Westinghouse Electric and Manufacturing interests at East Pittsburg. In brief, the plain has become a city, and yet the plain is such a valley that it can hold only the manufacturing plants, which stretch parallel with the river and the main line of the Pennsylvania Railroad and the hills; and a majority of the thousands of employés move morning and night upon the trains of the Pennsylvania Railroad between the Westinghouse factories and their homes in and around Pittsburg.

Fifteen years ago other growing electrical interests looked upon Pittsburg as a point of electrical contact that they might one day capture or absorb. Few people could believe that Mr. Westinghouse, with his air brake interests extending from the Pacific ocean to St. Petersburg in Russia, his Switch and Signal Company, the Westinghouse Machine shops, and the engineering firm of Westinghouse, Church, Kerr and Company, could make any great expansion in the electric field against the combined electric interests of New England and New York. Such expansion would seem beyond the driving force of a single human mind.

Yet, to-day, we find every Westinghouse company doing more business and earning more gross and more net money than ever before in its history, and the Westinghouse Electric Company close on the heels of the General Electric Company, representing the combined electric interests of New England and of New York, formerly known as the Thomson-Houston of Boston and the Edison of New York. And, as for the Westinghouse Air Brake Company, we find this year its $11,000,000 of capital stock not only paying its regular ten per cent and ten per cent extra, but a second extra of two and one-half per cent the last dividend period, and this notwithstanding the New York Air Brake Company, the newly grown rival of the Westinghouse Air Brake, is paying eight per cent upon its $10,000,000 of capital and doing one-third of the railroad air brake business of the United States. In a foreign field, where the New York Air Brake Company has invested $3,000,000 and has yet to see the return thereupon, the Westinghouse people had invested in advance $1,500,000 capital and earned it all back before the New York Air Brake Company got a footing.

It is generally said in Pittsburg that the employés of the United States Steel Corporation at this point represent or support a population of 100,000, but the Westinghouse interests at and around Pittsburg sustain a population of 75,000 people.

"How many employés have the Westinghouse interests?" was asked by the manager of the *Boston News Bureau* of the manager of the Westinghouse Machine Company at East Pittsburg a few days ago.

The answer was, "If you mean Westinghouse employés throughout the world, we were figuring it the other day and it reached the point of 75,000."

"Nonsense," spoke up Mr. Westinghouse; "we have not any 75,000 employés. We have 15,000 here in the Electric Company, and possibly 30,000 on all our payrolls."

"Here are the figures," responded the manager of the Westinghouse Machine Company.

"Oh!" spoke up Mr. Westinghouse, "you include the Westinghouse, Church, Kerr construction gangs. I do not call them employés. We can not allow that the number of employés on the payrolls of the Westinghouse companies is above 30,000."

"But," said the manager of the Westinghouse Machine shops, "here are 15,000 employés in the Westinghouse Electric Company, and, adding the other factories, the regular employés of the Westinghouse Company, you see by the figures, are far more than 30,000."

"Well," said Mr. Westinghouse, "I have not been here at East Pittsburg for many weeks and I see the shops are pretty full, but I don't think I will own up to more than 35,000 regular employés in all the Westinghouse companies in all places.

"There may be at one time 75,000 people working under the direction of the Westinghouse companies, including construction gangs. We may have 10,000 people one month in Colorado and some months afterward they may be working under the direction of somebody else. These are not our regular people. For regular, salaried people, I think we should not admit of more than 35,000." But even these figures seemed a surprise to Mr. Westinghouse.

The secret of Mr. Westinghouse and his ability to direct his organizations were soon revealed. After inspecting the new type of Westinghouse-Parsons turbines, which have recently been breaking the record for both prices and efficiency, he passed over to the works of the Westinghouse Electric Company and was shown some recent improvements which were going into very important electrical work.

"What shall I pay for this invention?" said the manager of the Westinghouse Electric companies. "You see its efficiency, from twenty per cent to thirty per cent saving at this point."

"Don't bother me with details," said Mr. Westinghouse, "you are paid a salary to run these works and get the best men, the best brains, and the best results."

"But," protested the superintendent, "he cannot speak English, and wants $10,000 a year for three years."

"All right," said Mr. Westinghouse, "take off twenty per cent so long as we have to supply the language," and the inventor's contract was on that day closed.

The secret of Mr. Westinghouse was revealed on the instant. He is an inventor, not alone in mechanics, but with men and with organization.

In twenty years but one financial criticism has been heard of George Westinghouse. Some bankers have called it extravagance, and others have called it too many high-priced men, but the results speak. Mr. Westinghouse does not organize a factory and then run about in bewilderment for somebody to run it. He first buys brains, and then he weaves organization about these brains to produce results, and gets them. He builds in as absolute faith as the farmer plants his corn, in the same faith in which Carnegie and Schwab built steel works, Rockefeller stored oil, or Morgan hives money—the faith that removes mountains because it refuses to recognize their existence.

The Westinghouse Machine shops, with less than $5,000,000 of its $10,000,000 of share capital issued, pays dividends of ten per cent and must be earning very much more, as it has 4,000 employés, and its yards and factories are not only crowded and whirring with the largest kind of machinery, but the units turned out are of the largest size, and must represent a considerable amount of money. One-half the works is devoted to the manufacture of steam turbines, while the Electric company adjoining manufactures the electrical parts.

With natural gas delivered in the machine shops at ten cents per 1,000 feet, one can readily understand why Mr. Westinghouse has devoted so many years to the development of the gas engine, to the manufacture of which a considerable part of the machine shops is devoted. Mr. Westinghouse says that whenever or wherever municipal gas reaches the point it can be sold to the consumer at sixty cents per 1,000 feet, gas engines will revolution-

ize light and power. At present gas in cities is steadily going down and the gas engine business is steadily coming up.

The Westinghouse Electric Company must be measured by the acres occupied, number of employés, the gross tonnage, and the gross values produced. The Westinghouse Machine shops occupy twenty-two acres and the Electric Works, forty-two acres. A few years ago the General Electric Company figured 14,000 employés and a gross business of $30,000,000 per annum. To-day the Westinghouse Electric Company has 14,000 employés, and its business has this fall passed the point of $3,000,000 outturn per month, so that gross earnings are now at the rate of $40,000,000 per annum.

The floor space occupied by the Westinghouse companies exceeds the floor space of the St. Louis Exposition and the largest of all the Westinghouse companies is of course the Westinghouse Electric. This company seems not only to eat up acres of ground and swallow in thousands of employés each morning, but the employés have to go out in differently timed companies at night in order not to more dangerously overcrowd the platforms and cars of the Pennsylvania Railroad.

It eats up capital in million-dollar junks. Its inventories show $12,000,000 of material in process. Its warehouses and yards have to be filled to overflowing with more shapes and sizes of iron, steel, etc., than even a United States Steel Corporation could be expected to keep on hand for immediate delivery. More than 2,000,000 pounds of copper per month go into this factory.

English Experiment of Shipping by Electric Wagons.

Consul Albert Halstead reports from Birmingham that an experiment is being made in North Staffordshire with a seventy-horse-power motor wagon for heavy freight traffic that may have far-reaching results, especially in the United Kingdom, where distances between industrial centers and to the seaports from the interior are comparatively short. Mr. Halstead writes:

"The present experiment in using a heavy motor wagon, capacity six tons with a trailer carrying four tons, to carry goods from Hanley to Liverpool is especially interesting to Birmingham, whose manufacturers constantly complain of high freight rates, unfair and inequitable classifications, and the autocratic attitude of the railways that act in concert, even though there is no concentration of ownership. A Birmingham paper says that 'if the scheme should prove successful, the promoters hope in time to run wagons also to Manchester and Birmingham and to tap the big railway companies at convenient points. As the scheme develops the promoters propose to establish depots and warehouse accommodation in the same way as railway companies, and they profess to have every hope of a successful issue to their enterprise.'

"If it be found that freight can be carried expeditiously and economically by motor wagons the industrial situation of the United Kingdom will be materially strengthened. High freight rates, which seem inevitable because of very heavy capitalization of British railways, which was due to the immense cost of their initial construction, are a serious toll on British commerce. Canal traffic is important and helpful, but very slow. The canals are also small and many are owned by the railways. Compared to the splendid system of canals in Germany and France with their low freight rates, the United Kingdom is at a serious disadvantage and feels it more and more because of German competition for the markets of the world, which becomes more aggressive and keener each year. Then, too, German exporters have the advantage of lower railway rates on merchandise destined for export, while the greater regularity of shipment of foreign goods into the United Kingdom results in what are really better rates on merchandise and food products that come from abroad than are obtained by those destined for export. In these circumstances pronounced demand for the improvement of the British canal system, and even for its nationalization, is not surprising.

"If heavy motor wagons prove successful carriers of freight, the further development and improvement of the canal system will not be so important, railway freight rates will naturally come down, whatever arbitrariness there may be on the part of railways will disappear, and the Kingdom will be in far better position to hold its own in the markets of the world, and even to increase its share of those markets.

"There is little reason why the experiment with motor-wagon freight carriers should not be successful here. Roads are almost universally good, distances are not great, motor construction is improving and the output increasing; while rates for carriage should remain low because the highways are free. There can, therefore, be no monopoly of the new method of freight transportation which experts have declared would certainly result from the development of motor wagons."

Cooperative Electrical Development Association.

Arthur Williams, president of the National Electric Light Association, arranged a few weeks ago, a committee of five central station managers to cooperate in the developing and execution of the plans of the Cooperative Electrical Development Association.

This committee, which consisted of three members last year, has been enlarged this year to a committee of five, consisting of the following representative gentlemen: W. W. Freeman, Brooklyn Edison Company, chairman; John W. Gilchrist, Chicago Edison; R. S. Hale, Boston Edison; J. E. Montague, Buffalo and Niagara Falls Electric Light and Power Company; F. M. Tait, Dayton Lighting Company.

Paul Spencer, the previous chairman, rendered excellent service in the development of the plans last year, but special attention required on another committee necessitated his withdrawal.

Mr. Freeman called a meeting of the above committee in Brooklyn on October 30, and the entire day was given over to a careful and detailed consideration of the proposed constitution and by-laws, as well as the detailed commercial plans for 1907, submitted by J. Robert Crouse. The committee was honored for a good portion of the day by the presence of President Williams.

This conference, which will be followed rapidly by similar conferences with the cooperating committees of the manufacturers, jobbers, contractors and representatives of the technical press and advertising agencies, is all preliminary to a meeting of the joint committee of all branches of the trade, to be held in New York within a few weeks, at which it is expected to formally complete and finally agree upon a scheme of organization and the commercial plans for work in 1907.

After a very busy day, Chairman Freeman and his associates, W. F. Wells, Joseph F. Becker, Jr., P. R. Atkinson and M. S. Seelman, gave a dinner for the confreres at Delmonico's, followed by a theatre party. The day's activities concluded very pleasantly with a luncheon and smoker given by President Williams.

It was the unanimous expression that the day had been crowded as full of "Cooperation," both business and social, as was possible, and this meeting doubtless marks a long step in the progress of this cooperative compaign, which is now being recognized by all branches of the trade as having great commercial possibilities.

Electrification of the West Jersey & Seashore Railroad—II.

Description of Transmission System, Third-Rail Construction and Car Equipments.

THE 33,000-volt high-tension transmission line is in duplicate throughout. It is Y-connected with the neutral grounded and consists of six No. 1 B. & S. hard drawn copper wires mounted on porcelain insulators. The poles are of chestnut, their height being forty-five feet, with extra long poles where special conditions require. They are spaced 125 feet apart, but at street crossings the spacings are reduced to 100 feet. Head guys are used at distances of approximately one-quarter of a mile. There are two cross-arms, the top arm being twelve feet in length, carrying four insulators, and the lower arm, which is eight feet six inches, carries two insulators. The six wires form two inverted equilateral triangles, and the insulators on each triangle are forty-two inches apart. These wires in each triangle are transposed by one complete spiral between each substation. Locke insulators are used, made in three parts and designed to stand double the working pressure. Each petticoat was tested separately—the top section to 45,000 volts, and the assembled insulator was subjected to 85,000 volts for ten minutes, and also a precipitation test was made at 52,500 volts. The insulators are mounted on iron pins.

The method of protection from lightning consists of a seven-strand galvanized steel cable five-sixteenths inch in diameter strung for the entire length of the line on top of the transmission poles, four feet above the nearest active wire, and provided with ground connections at every fifth pole. This form of protection from lightning is believed to be an efficient supplementary adjunct to the arresters.

In all there are seventy-one miles of transmission line.

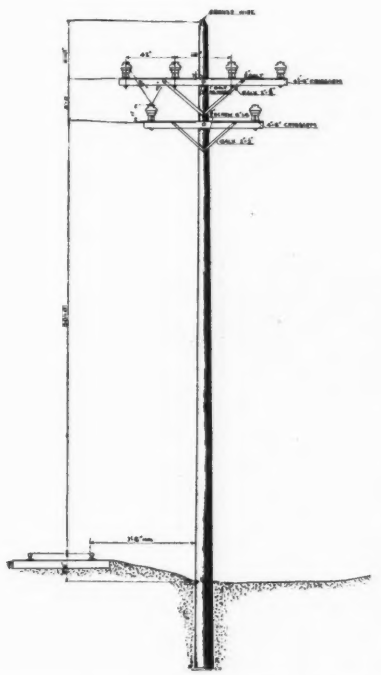
THE THIRD RAIL AND TROLLEY.

The proposition of installing the third rail for the double-track road of this length in the prescribed time demanded a considerable amount of skill on the part of those organizing the work, and the fact that a large amount of steam traffic and double tracking was going on at the same time materially added to the difficulties of the undertaking.

The Pennsylvania Railroad Company provided and installed all the necessary long ties on which the insulators are placed, and also provided and distributed along the track all the third rail, third-rail splice bars and bolts.

The rails used for this purpose are of the Pennsylvania Railroad standard cross-section and composition; they are in lengths of thirty-three feet, weighing 100 pounds per yard, and have a conductivity about equal to that of a copper rod of 1,200,000 circular mils. This type of rail was used in order that it might be interchangeable with the track rails.

The insulators are reconstructed granite, and are held in position by a metal centering cup which is secured to long ties by means of a lag screw. The insulators are ten inches in length and five and one-half inches broad at the base with an effective depth from the bottom of the rail to the tie of three and one-half inches. An advantage of this method of securing the position of the insulator is that on the ties being depressed by the passage of a train no tension strain is brought to bear in the insulators. The insulators are spaced about eight feet apart. The top of the third rail is three and one-half inches above the top of the track rails, and its gauge twenty-six inches distant from the gauge line of the adjacent track rail, these dimensions constituting the standard of the Pennsylvania Railroad and the Long Island Railroad, which is interchangeable with the Interborough Rapid Transit of New York city.



ELECTRIFICATION OF THE WEST JERSEY & SEASHORE RAILROAD—HIGH-TENSION TRANSMISSION LINE.

The approaches of the third rail are made of cast iron. The third rail is bonded with concealed ribbon bonds with solid copper terminals compressed into one-inch drilled holes in the rail. There are two bonds to a joint, and each has an area of 500,000 circular mils.

The third-rail jumpers are of a specially neat design. They are used at all grade crossings and wherever a continuous third rail is impracticable. The cable is drawn into a black bituminized fibre tube, which is laid in a solid concrete protection. Terra-cotta covers are employed to protect the cable terminals. Those for single cable jumpers are of the round form and those for double cable of an elliptical shape as shown.

The third rail is anchored at intervals; this is accomplished by means of metal clamps secured to the under flange of the rail in such a position as to engage the insulator on each side. The third rails are arranged in such a manner that each track may be isolated from the other, but normally the third rails are electrically connected midway between the substations through a combined switch and fuse box, thus obtaining the combined conductivity of the third rails. There are also section insulators opposite each substation so that in the event of an accident on any part of the system only a short section of the third rail would be dead.

The right of way is fenced in, and at all crossings the fence turns in from the property line to meet Climax cattle guards at the edge of the crossing. In this way the public is prevented from reaching the third rail.

At all stations and in the Atlantic City and Camden yards, the third rail is protected by a wooden top and side guard, consisting of a two-inch plank carried on castings attached to the top of maple posts, which are secured to the third rail at intervals of about six feet. The top casting is of such form that although it is provided with a web for strength no part of it extends either above or below the protection plank.

Opposite all platforms the rail is further protected by a plank fastened to the side. Wherever possible, the rail is kept between the tracks, and is therefore on the side of the track farthest from the station platform, and inter-track fences are provided

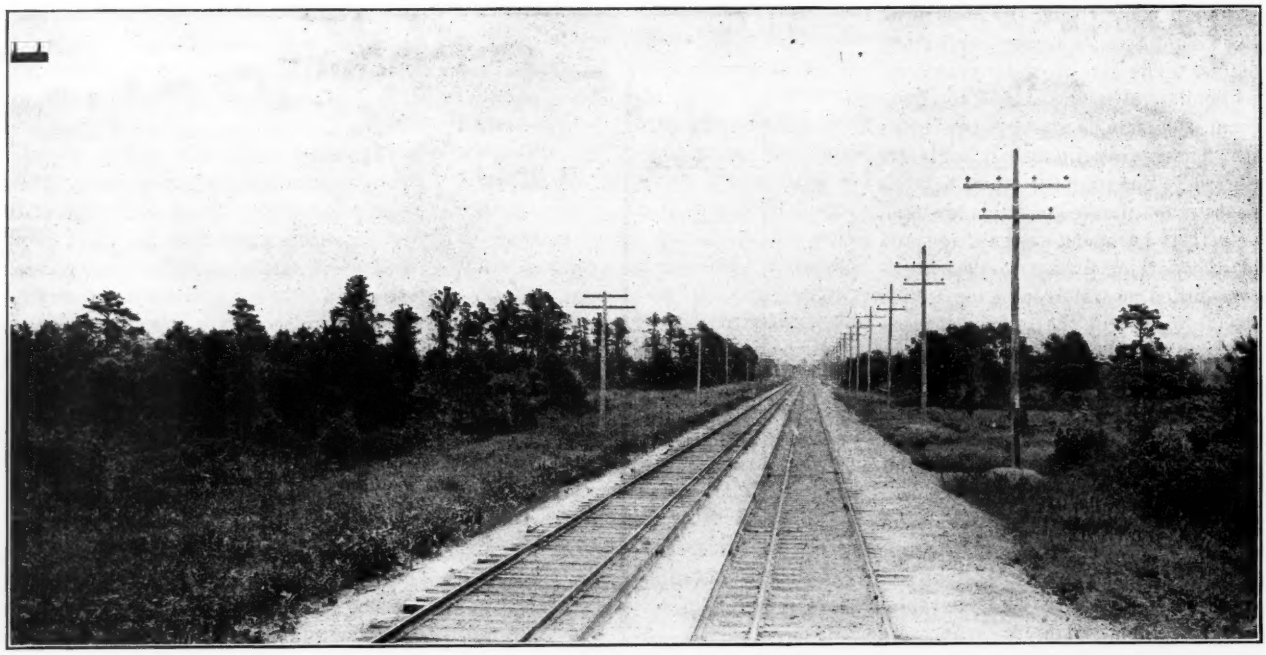
to prevent crossing the tracks. In order to prevent passengers or others on the platforms from touching the contact shoes on the platform side of the car, there is a protecting plank similar to the third-rail protecting plank but carried on castings fastened to the ties. The shoes are at all times under this plank and therefore protected. This is used at all stations, even where the third rail gives way to the trolley, although there is a switch on the car which enables the contact shoes to be cut out when operating from the trolley.

At Atlantic City, where the tracks cross the Thoroughfare, a new drawbridge has been built. The third rails on this draw are connected to the third rails on the approaches by sliding contact shoes, so that when the draw is closed the rail is continuously connected. In addition to this, two 1,000,000-circular mil submarine cables are provided connecting the rails so that the opening of the draw does not interrupt the circuit. The submarine cables for the return circuit are bare.

A point of great interest is to be found in the fact that the third-rail system has been adopted at both terminal stations where there are a number of platforms, and it will be interesting to engineers to learn that this system was adopted on the score of less difficulties being encountered in its installation than would have been the case had an overhead trolley been erected.

BONDING OF MAIN TRACKS.

The bonding of the main track between Camden and Atlantic City was done with a heavy steam traffic in progress during the whole period. All the holes were drilled by hand and the bond terminals were expanded by means of screw compressors. Two bonds of the concealed type were used per joint, each with a capacity of 400,000 circular mils, and on account of the large size of bonds special angle plates had to be provided. This work was performed almost entirely with untrained labor under skilled foremen. The men were given a royalty of five cents on each hole drilled above thirty per day, and some reached as high as eighty in a day's work. The railroad company required that one splice bar should always be kept in place against the rail to provide for the safe operation of the passing trains.



ELECTRIFICATION OF THE WEST JERSEY & SEASHORE RAILROAD—ROAD-BED NEAR MIZPAH, N. J.

TROLLEY LINE.

The trolley construction between Newfield and Millville and on the stretch of track between Haddon avenue and South Gloucester is of the span type, with poles spaced at a distance of 100 feet, and where practicable the high-tension transmission poles have been used for supporting the span wires. Through Camden the greater part of the trolley construction is on tubular steel poles. The trolley is suspended twenty-two feet above the top of the track rails.

There are no copper feeders used on the third rail, but those for the trolley lines are as follows: Two 750,000-circular mil feeders from South Camden to Haddon avenue. One 750,000-circular mil feeder running from South Camden to Brown's Crossing.

Both of these form a conjunction with the third rail. The copper feeder between Newfield and Millville is 500,000 circular mils in section.

The length of line between Newfield and Millville is approximately ten miles. The trolley wire is of No. 0000 grooved section. The bonding is similar to that already described on other portions of the road. The span wires are of stranded galvanized steel, three-eighths-inch in diameter. The lightning arresters are installed at approximately 1,000 feet apart. All pull-offs, strain ears, feeder ears and splicing sleeves are of bronze, and as these items, together with all other line material, such as frogs, etc., are of standard pattern, a further description would be superfluous.

CARS.

For initial service sixty-two passenger cars and six combination baggage and mail cars have been provided. All of the cars are motor cars, the motor and control equipment being the same in all. The design resembles that of the standard Pennsylvania coaches, except that the height is less to decrease the weight, the shape of the roof is changed and the interior finish is of mahogany instead of oak.

The seating capacity is fifty-eight passengers and the seats are of the standard type, made by the Hale & Kilburn Manufacturing Company. Both ends of the cars are provided with vestibules and have

the standard arrangement of steps, trap doors and vestibule side doors. The vestibule centre door is so arranged that when it opens it slides over and encloses the control apparatus.

The entire underside of the car is protected by one-quarter-inch transite and above the motor truck steel plates over asbestos fire felt is used. The general dimensions of the car are as follows: length over buffers, fifty-three feet five and one-half inches; length over body end sills, forty-six feet six inches; truck centres, thirty-three feet; width over eaves, ten feet one and one-quarter inches; height from top of rail to top of roof, thirteen feet three and thirteen-sixteenths inches; total weight of car, fully equipped, 89,000 pounds.

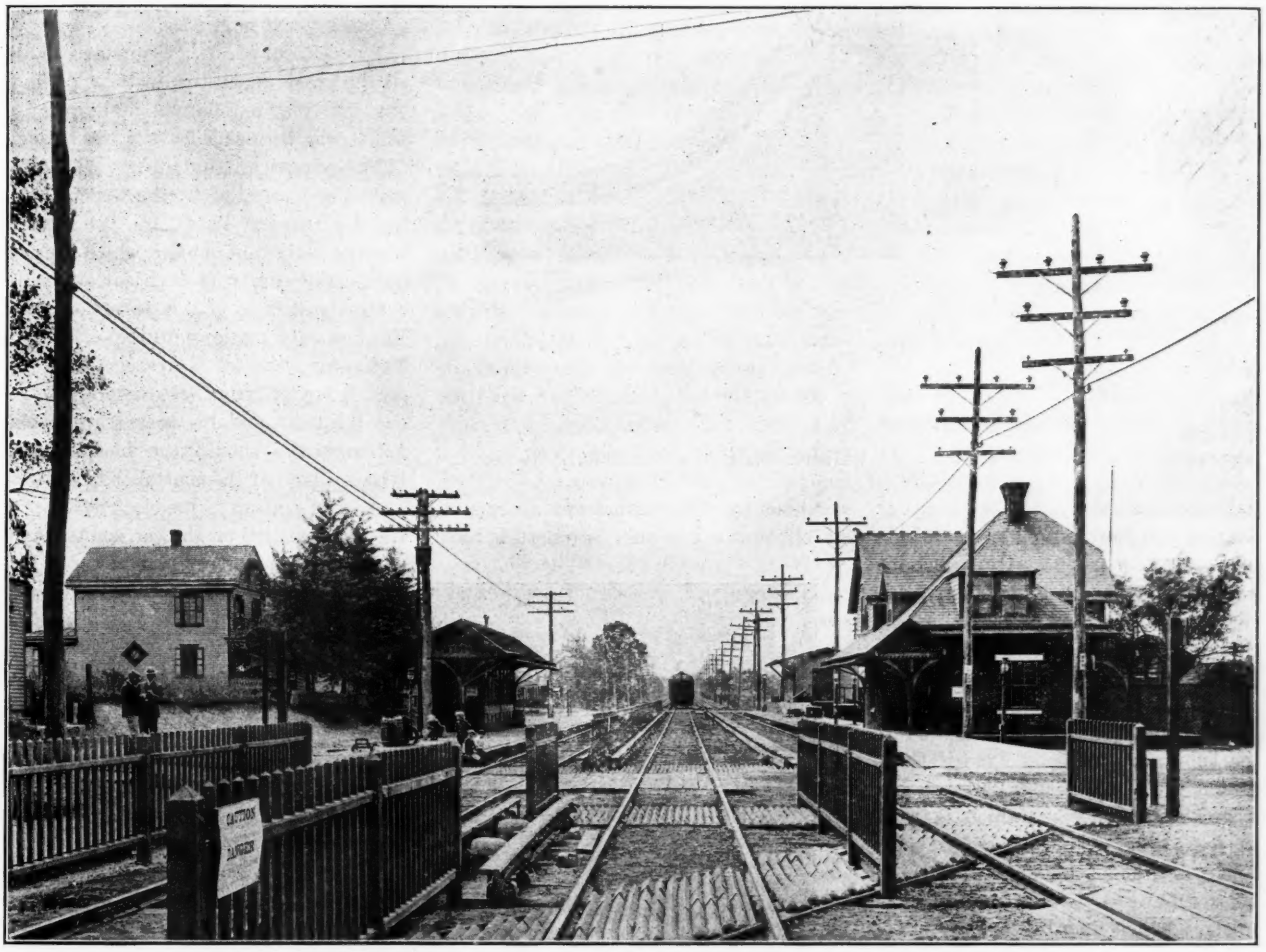
The combination baggage and mail cars are of the same general dimensions as the passenger cars and have similar vestibules. The mail compartment is twenty feet long inside and the baggage compartment is twenty-nine feet nine and one-quarter inches long inside. The arrangement of the baggage compartment is similar to the standard Pennsylvania Railroad combination car and the fittings and arrangements in the mail compartment are in accordance with the standard requirements of the post-office department.

All cars are provided with a fifty-candle-power incandescent electric headlight and two electric markers or route lamps on the hood at each end. These were manufactured by the Dressel Railway Lamp Works, of New York. In the interior of the car there are five five-light clusters and in the saloon there is a single lamp. There are two lights in each vestibule, one being over each trap door, arranged in reflectors so that the lamp does not come below the vestibule ceiling. All wiring for lights is done in galvanized iron conduit on the roof of the car so that it is at all times accessible. Where the conduit goes through the roof to the fixtures, special roof-plates are used, laid in so as to be watertight. On the roof, in the centre of the car, there is an illuminated numeral panel which permits the car number to be read from either side. The lamps in this panel are in the headlight circuit so that they are only lighted on the leading car of the train.

Each car has two trolleys, each with a retriever, and on the roof between the trolley bases there is a box containing the lightning arrester, trolley cutout switch and trolley fuse. Steps are provided on the vestibule corner posts and there are grab irons and roof platforms to permit of easy access to the roof.

The cars are heated by Gold cylindrical heaters, one being under each seat and a total of twenty-eight heaters per car. There are two coils in each heater, thus providing three rates of heating.

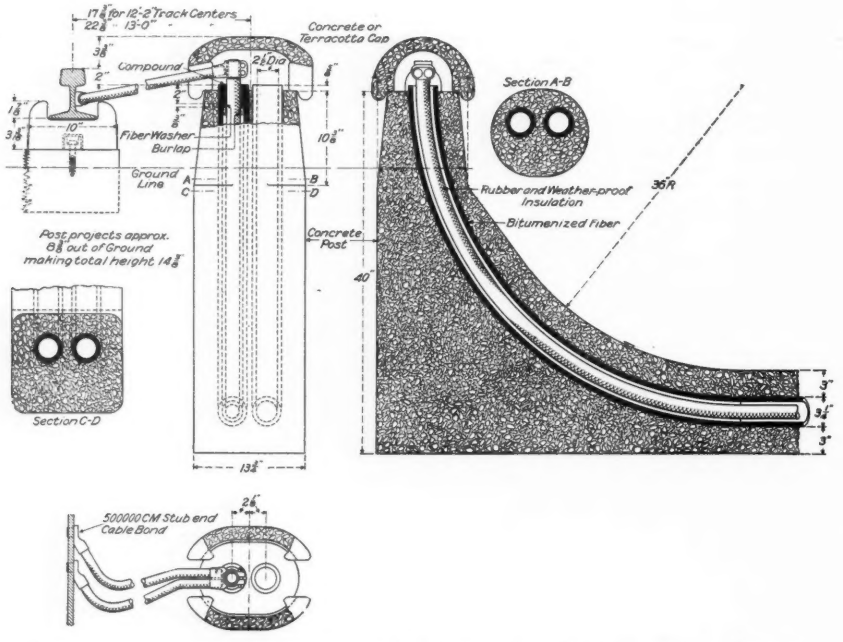
In the vestibule, at the saloon end of the car, on the motorman's side, there is a switchboard on which are mounted the headlight and air compressor switches and fuses, the switch for cutting out the contact shoes when operating on trolley, the trolley cutout switch and the current limit relay. This switchboard is provided with double steel doors lined with asbestos and is accessible from the vestibule. This switchboard, as well as all conduit wiring



ELECTRIFICATION OF THE WEST JERSEY & SEASHORE RAILROAD—CATTLE GUARDS AND THIRD-RAIL COVERING, WESTVILLE, N. J.

and fixtures for heating and lighting, was installed by the General Electric Company.

The Wason Manufacturing Company, of Springfield, Mass., built twenty-two of the passenger cars and the six combination baggage and mail cars; the American Car & Foundry Company, of Wilmington, Del., built twenty-eight passenger cars, and the J. G. Brill Company, of Philadelphia, Pa., eighteen.



ELECTRIFICATION OF THE WEST JERSEY & SEASHORE RAILROAD—THIRD-RAIL JUMPER.

TRUCKS.

The motor and trailer trucks are of the M. C. B. double side bar equalized type, somewhat similar to those used on the cars of the Interborough Rapid Transit Company and the Long Island Railroad, but with greater wheel base, which is here, seven feet. The weight of motor truck complete, without motors, is 14,934 pounds, and the weight of trailer truck complete, 9,633 pounds.

The wheels of the motor truck are steel-tired, with separate cast-steel spoke centres. They are thirty-six inches in diameter with M. C. B. standard tread. Tires are three inches thick, shrunk and bolted to the steel centre. The journals are five inches by nine inches, the diameter of the axle at the wheel fit is five inches and diameter between wheels is seven inches, finished all over.

The motor and trolley trucks for sixty-five cars were built by the Baldwin Locomotive Works, of Philadelphia, Pa., and for three cars by J. G. Brill Company, of Philadelphia, Pa.

The cars are equipped with hand brakes and with Westinghouse quick-service automatic air brakes.

The motor-driven air-compressor, with its governor, together with the whistle, are all of the General Electric Company's manufacture. The compressors are mounted on two oak planks, supported by a cradle of wrought-iron bars. The cradle is suspended beneath the car near the motor end and permanently bolted to the sills. The compressor consists of a duplex single-acting air pump, driven by a herring-bone gear and pinion from a railway-type motor. All parts of the pump and motor are easily accessible and are designed so as not to be damaged by the severe conditions met with in this class of service. The motor is of the entirely enclosed type, and required no additional housings or protection of any kind. The governor is a combination of diaphragm, piston, springs and operating levers connected to a single-pole switch of a type similar to the contactors used in the motor circuits. The working parts are protected by a hinged cover which can readily be dropped for inspection.

The General Electric Company installed all the brake apparatus, including piping, but not the foundation brake rigging, which was furnished by the car builders.

The electrical equipments were furnished and installed by the General Electric Company. There are two General Electric sixty-nine motors which are 200-horse-power units on each car, while the control system is of the Sprague-General Electric automatic multiple-unit type. The controllers are so arranged that current is cut off from the motors throughout the train and the brakes are applied automatically should the motorman release his hold of the controller handle.

A large portion of the electrical apparatus was installed on the car bodies during their construction at the works of the three car builders. All the cables for the electrical conduits are run in grounded loricated conduits, the outlets of which are provided with rubber-bushed bell mouths.

ELECTRIFICATION OF THE WEST JERSEY & SEASHORE RAILROAD—INTERIOR VIEW OF MOTOR CAR.

The conversion of the lines of the West Jersey & Seashore Railroad above described from steam to electric traction was carried out by the following organizations:

The construction of the terminals, inspection sheds, double tracking, changes in existing tracks, grading, new bridges, changes in telegraph lines and installation of a special telephone system, were carried out by the regular engineering and maintenance-of-way departments of the Pennsylvania Railroad Company.

The installation of the interlocking plants and automatic block signalling was carried out by the Union Switch & Signal Company in accordance with plans of the signal department of the Pennsylvania Railroad Company.

The new cars and trucks required for the electric service were designed by the motive-power department of the Pennsylvania Railroad Company.

The entire contract for the electrical equipment, including the construction of the power-house, substations and the electrical equipment on the cars, was awarded to the General Electric Company, and in accordance with the plans and under the supervision of George Gibbs, chief engineer of electric traction, in consultation with the officers of the railroad company. Stern & Silverman, of Philadelphia, were appointed by the General Electric Company as their general subcontractors, and the Scofield Company, also of Philadelphia, acted as general engineers for the power-house and subcontractors for the piling and foundations.

The whole of the electrical work was under the personal supervision of W. B. Potter, engineer, railway engineering department, General Electric Company, directly assisted by J. Elliot Hewes, C. E. Eveleth and W. H. Clapp.

The Production of Platinum in 1905.

The year 1905 saw a phenomenal rise in the price of platinum and a greatly increased production in the United States. The annual report of the United States Geological Survey on the production of platinum, prepared this year by F. W. Horton, contains details of exceptional interest. It shows that early in March, 1905, the price of ingot platinum advanced from $19.50 an ounce to $21 an ounce, surpassing gold in value. On April 1, 1905, the price fell to $20.50 and remained firm at this quotation until February 1, 1906, when it jumped to $25 an ounce, where it remained until September 1, or about six weeks ago, when it leaped to the unprecedented value of $34 an ounce. Mr. Horton's report also shows that the production of platinum in the United States increased from 200 ounces in 1904 to 318 ounces in 1905.

The rise in the price of platinum and its increased production in this country may be ascribed to two causes: the growing demand for the metal and the reduced yield of the Russian platinum placers, which usually furnish about ninety per cent of the world's supply.

The anxiety felt by the platinum dealers during the Japanese-Russian war has not abated since the settlement of international difficulties, but has rather increased as Russia's internal dissensions have developed. Even before the uprisings, it is said, the large Russian mines were purposely curtailing their production. This reduction of the output is due to the fact that the entire product for a varying term of years was bought up under contract and at prices that now seem ridiculously low. As the mine owners receive only the fixed price, they do not participate in any gain due to rise in value and are, therefore, not desirous of a large production, but are husbanding the limited resources of their mines until such time as they can dispose of their product to better advantage. Meanwhile the small mines, which, generally speaking, are not hampered by such agreements, are working to their full capacity to take advantage of the stimulated prices; but their entire output is only a small percentage of what is usually produced. A greatly increased consumption of platinum in the electrical and chemical industries, together with this stringency of supply accounts for the prevailing high prices.

The exhaustive tests and examinations of black sands commenced early in 1905 in connection with the Lewis and Clark Exposition, and still being carried on at Portland, Ore., by the United States Geological Survey, have done much toward placing platinum mining in this country upon a stable footing and developing it into a permanent and profitable industry. Not only have many discoveries of platinum in new localities been made, but the tests have revealed the fact that there are in this country districts which contain surprising quantities of platinum, and they have also given much valuable data as to the best method of obtaining it.

Platinum is now known to exist in fifteen counties in California: Butte, Calaveras, Del Norte, Humboldt, Mendocino, Nevada, Placer, Plumas, Santa Barbara, San Luis Obispo, San Bernardino, Shasta, Siskiyou, Trinity, and Yuba; in nine counties in Oregon: Baker, Coos, Curry, Douglas, Jackson, Josephine, Lincoln, Linn, and Union; in eight counties in Idaho: Ada, Bingham, Boise, Elmore, Idaho, Nez Perces, Oneida and Shoshone; in four counties in Colorado: Chaffee, Park, Saguache, and San Miguel; in three counties in Washington: King, Skagit, and Whatcom; in two counties in Montana: Custer and Granite; in Utah, in Garfield county; in Arizona, in Yavapai county; and in Wyoming, in Albany county. The metal is also rarely found in Alaska and in the gold bearing sands of Corozal river, Porto Rico. Isolated occurrences of single nuggets or mere traces of the metals have been found in many other counties of these states, as well as in four of the eastern states, namely, New York, Pennsylvania, North Carolina, and Georgia. In many of these localities the metal occurs but sparingly. The most promising fields are in the counties of southern Oregon and northern California. Here the metal has been found in commercial quantities. With proper methods a considerable annual output should be obtained.

The platinum metals are usually found in working gold placers, especially where the gravels are derived from peridotites. Many managers of placer mines have been convinced for a long time that it would pay to save the platinum in the gravels, if it could be done by some inexpensive method. The experiments of the Geological Survey which were conducted under the supervision of Dr. David T. Day, have shown conclusively that ninety-five to ninety-eight per cent of the precious metals both gold and platinum, contained in the sluice box sands can be saved on concentrating tables of the Pinder or Wilfley type, such as are used in everyday practice; and that in most cases the concentrates thus obtained will represent less than one per cent of the total weight of sand fed to the table.

Besides discussing the experiments made in the recovery of platinum in this country, Mr. Horton describes the methods of extraction in vogue in Russia.

It should be noted that the imports of platinum during 1905 were valued at $2,173,263, as against $1,879,155 in 1904, an increase in value of $294,108. Considering the increased demand for platinum, the gain in importation is slight, but if the high price and scarcity of the metal be taken into account the wonder is that there was not a large decrease in the quantity imported.

This report of Mr. Horton's is published as an advance chapter of the annual volume, "Mineral Resources of the United States, 1905," and is distributed, free of charge, on application.

ELECTRIC RAILWAYS IN SPARSELY SETTLED COMMUNITIES—II.[1]

BY E. P. ROBERTS.

(Concluded.)

Generally, interurban roads entering a city of any considerable size use the tracks of the local street-car system, but sometimes it is possible to obtain an independent entrance, and, when the financial condition warrants it, this is preferable. It is, however, seldom warranted unless the anticipated travel is very considerable, and, of course, is materially affected by the cost of construction required in the city, including the cost per mile and total mileage, which includes the first cost and the maintenance of street paving, sprinkling charges, if any, etc., and city taxes. It also depends upon what arrangement can be made with the local company for operation over its tracks.

In a general way the shorter the route in the city, or more correctly, the less the time of the run in the city, the better for the interurban railway.

The foregoing materially depends upon the frequency of service given by any competing steam road and by the time required between the station of the steam road and the retail centre, not only in the principal terminal city, but also in the principal towns along the route.

Another point is the location of the road in cities and towns along the route. The receipts of an interurban electric railway depend largely upon the accessibility of its cars and its frequent service, but, on the other hand, accessibility in the cities and towns generally means somewhat increased first cost, also a longer time for the run. If freight cars are to be handled it means considerable additional trackage for the freight line.

In addition to the foregoing, the recent development of the alternating-current motor system makes it desirable for such roads as use such system to keep on private right of way to as great an extent as possible, and when in cities and towns to use only such streets as will allow the use of high-voltage trolley. As a matter of fact, high-voltage trolley is now used in some towns of considerable size and on roads passing through the heart of same, but it is hardly probable that this will be permitted in all towns. In some locations it may not be found advisable even if permitted.

Having made a preliminary location and ascertained the distances in the cities, towns and country; having considered that a certain sized passenger car operating on a certain headway will give the best service, and on the presumption that, all things considered, a certain grade will be most economical, a train schedule is prepared showing the time of the run for passenger service. There will generally be two train schedules, one for express and the other for local service.

It is advisable that the trains should follow at regular intervals, which intervals, however, may be varied at different times of the day and at different seasons, but the trains should always start from one end on the hour, and when more frequent service is desired, half-hourly and quarter-hourly. The time of leaving the other end should also be on the hour, or at some regular division, such as the half or quarter-hour. It is evidently necessary, therefore, to provide motors which will make such speed as is required to give a schedule enabling a car to make the run one way and provide at the end of such run sufficient time for layover, so that it can unload and load with sufficient leeway, and, in case of delays, it will still start out on the return run on the schedule time. The time of the run in the principal city is dependent upon the schedule time of the city cars if the local company's track be used, or upon local ordinances and conditions if the interurban company has its own track. The schedule speed in the principal terminal city will probably be approximately eight to twelve miles per hour, being somewhat less in the congested portion of the city run, and possibly slightly greater in the suburbs.

The same conditions apply to the runs in the towns along the route, although generally to a less degree, but in any case the schedule in cities and towns is based on local conditions, and not upon the speed obtainable by the motors.

The speed on the country run, which for modern roads is generally on private right of way, depends upon the grade, and, for any given weight of cars, upon the power of the motors, and, of course, upon the maintenance of the voltage. The schedule speed depends upon the above and also upon the number of stops.

The length of layover is often of material bearing on the question of size of motors. Sometimes by allowing a car to layover at one or both ends of the run for fifteen or thirty minutes it is possible to use a smaller motor than would otherwise be necessary. Such layover is seldom objectionable, as it gives an opportunity to sweep out and clean up a car, and frequently when the car barn is at one end of the terminal, it is possible to provide such a layover without any additional expense. By so doing, a material saving can be made on the first cost of all the car equipments, and may more than offset the first cost of the extra cars and equipments which may be required, and the repair and depreciation may be less. Actually it is seldom that additional cars would have to be purchased as there are always supposed to be enough cars for special occasions.

The number of stops made by a car has a very decided effect upon the size of motor necessary to drive it, and with any given schedule and car the less the number of stops the smaller and cheaper the motor equipment.

Taking a given car geared to a maximum speed of forty miles per hour, with eight stops per mile, the possible schedule speed is less than ten miles per hour. With four stops per mile the possible schedule is less than fifteen miles per hour. With two stops per mile the schedule speed is about twenty miles per hour, and with one stop per mile the schedule speed is about twenty-six miles per hour. On the other hand, with one stop in eight miles a schedule speed of thirty-four miles per hour can be made. Of course, the above is based on having a level and straight road.

Had the same car been equipped with motors geared to but thirty miles per hour, it would have made with eight stops per mile a schedule speed of eight miles per hour, which is practically the same as before; with four stops per mile it would have made a schedule of thirteen miles per hour; with two stops per mile a schedule of seventeen miles per hour. The schedule will not only be practically as good as that made with higher gearing, but also the motor equipment can be decidedly smaller and cheaper, and the fluctuation of load at the power-house will be much smaller than that resulting from the higher-speed car.

Some roads have larger cars than are most economical for the service, and the use of smaller cars is of additional value by reducing the size of motor equipment required, and by lessening the fluctuation of load at the power-house. Smaller cars also permit of lighter track construction, small substations and, in fact, lower costs generally. On the other hand, if travel is great enough so that a small car can not handle the traffic, then two cars can be run on half of the headway with but little more cost, except as to train crews, than for the operation of one large car, with the result of much better service, with

[1] Abstracted from a paper read at the convention of the American Street and Interurban Railway Association, Columbus, Ohio, October 18.

consequently increased income, and with comparatively small increase in the power-house and substation equipment required.

If, for example, a preliminary estimate shows that it will take two hours to make the run over the proposed road, forty miles in length outside of the principal city, and possibly three miles therein, it is evident that a time-table based on cars leaving such end of the route on the hour will necessitate the car leaving at the same time as it arrives; in other words, there is no provision for layover. It is evidently necessary to lessen the time of the run, and this must be done by lessening the time of the run in the cities and towns, which presumably can only be done by lessening the length of the run in same, especially the run in the congested district, or by increasing the speed of the cars, requiring, therefore, more powerful motors, or by reducing the number of country stops, which necessitates a consideration of the effect of same on travel, or by reducing the grades, and unless the grades are considerable, the amount of the reduction, as far as time is concerned, will generally be found quite small and not comparable with lessening the number of stops.

When considering freight service the principal consideration is the train load, schedule speed within considerable limits not being of great importance, but the load which the electric locomotive can haul, requiring the service of only one train crew, is of vital importance. In connection with passenger service it is of great importance to make such schedule as will use the time of the train crews to the greatest advantage, as the cost of their time is one of the principal items of operating expense.

Having obtained a general view of the proposition, especially as to its general character and the approximate amount of traffic, and having from a map obtained distances, and from examination of a preliminary or a final profile, ascertained approximate grades and the amount of grading construction, the investigator is in a position to decide as to the general type of road, the system to be used (alternating-current or direct-current motors), and to prepare a preliminary estimate of first cost, cost of operation, and, most important of all, net income.

The preliminary report informs the projector as to whether or not the proposition has such merit as to warrant its construction, and if it is not warranted, then the sooner such fact is ascertained the less the time and money which will be wasted. If, however, it is warranted, then successful operation depends to a large degree upon the design being that best suited to the conditions; such amount of money being available as required in order to obtain the best net results, and its construction to be so supervised as to assure that the contracts are lived up to.

Some interurban electric railroads should never have been constructed, as under no conditions were they warranted. Others have been improperly designed, considered from the standpoint of obtaining the best net results. In some cases the construction has been of too expensive a character, and in other cases there has not been sufficient money expended on the construction. Other roads have not been properly maintained, and still other roads have not been properly managed. Of course, some roads come under more than one of the above classes. If, however, a road is justified, then its success, exclusive of its financing, depends upon obtaining the best location, proper design for the conditions, proper construction, competent operation. It is noted that the first three are dependent upon the expert adviser, and that the result which can be obtained by the fourth is largely affected by the attention given to the first three. Moreover, the first three are practically unchangeable after the road is constructed, whereas the fourth, if in incompetent hands, can be changed.

If the project is warranted, then the maximum degree of success in financing depends largely upon the proper presentation of the proposition. There should be a short, clear and concise statement as to the territory served, the estimated first cost, and the gross and the net income, followed by such detailed estimates, statements and other information as experience indicates is desired by financial houses.

When it is decided to construct the road a location survey is made, which may or may not have been preceded by a preliminary survey. The latter may have been, and frequently is, made prior to the preparation of the report submitted as the basis of the financing. In fact, sometimes a location survey is made prior to such time.

The object of a preliminary survey is to ascertain distances more accurately than are generally obtainable from published maps, and also to more closely approximate the grades and amount of grading than can be ascertained merely by going over the route, although, as before stated, if the country is reasonably level, an expert in such work can quite closely approximate the amount of grading.

Preliminary surveys of alternative routes are frequently made and are useful for comparison of length of routes, cost of construction, comparative value of route from earning basis, and are sometimes of assistance in obtaining rights of way at minimum cost.

As the civil and mechanical electrical engineering departments are closely related, it is necessary to decide as to what grades will be most economical. Reducing the grades adds to first cost and also adds to the maximum power required, and consequently, unless storage batteries are used, reducing the ratio of average power to maximum power, and such reduction increases the cost of fuel. The effect of grades on passenger schedule must be noted and also on the load which the freight locomotives can haul. In a general way, it is evident that the most frequent the service and the heavier the trains, the greater the amount which it can be most economically expended in the reduction of grades, and as a future improvement of grade will require a greater expenditure than if such grade were established at the start, it is wise to give consideration to the somewhat distant future.

Having decided as to the grades, the train schedules and the motor equipments, the next point is to provide for the furnishing of power to the cars. Presumably decision has been reached as to the system to be used, also as to the most desirable location of the power-house and substations. The next point is to definitely determine the general character of the machinery for same and the rated capacity and number of the various units.

Each substation must have sufficient capacity for maximum demand, and judgment must be exercised as to whether to provide any reserve capacity in excess of such maximum. The number of units must be such as will furnish power for the average load, even though one unit be crippled, and also will enable the units in operation at any one time to operate as nearly as possible at their rated capacity. It is also desirable not to have an excessive number of units, as for a definite total capacity this increases the first cost.

The general proposition as to the design of the power-house is the same as above stated for substations, but on the basis that such power-house is to be a steam plant, careful study must be made of the cost and character of fuel, the required draught

for such fuel, the best ratio of grate to heating surface; and if compound engines are used, the best ratio of cylinder diameters in order to obtain the maximum economy under operating conditions, taking into account steam pressure, superheat, if any, and the most economical vacuum.

It will be noted that the preceding necessitates a predetermination of the load curve, the probable momentary and short period fluctuations, and, as before stated, and these are affected by the grades, the weight, maximum speed and schedule speed of the cars, and by the train schedules, all of which indicates the close interrelation of the various factors entering into the problem of so designing an interurban electric railway as to obtain the maximum rate of dividends.

After all plans and specifications are prepared, the contracts are awarded, and it is unnecessary to state that there is considerable opportunity for saving money in awarding contracts.

The next step is to so supervise construction as to assure that the contracts are fulfilled. When construction is completed and accepted, then the road is turned over to the operating department, and on the basis that such department is competent, the results obtained depend very largely upon the character of the work which has preceded. A comparatively few extra dollars expended in assuring the best possible design and construction will probably save many times the interest on such additional expenditure, and there is no investment which pays as large dividends as that which can wisely be expended in order to "start right."

Electrical Machinery Breakdowns.

Michael Longridge, the chief engineer of the British Engine, Boiler and Electrical Insurance Company, Limited, of Manchester, England, has for some years past made a special point, in his annual reports, of selecting from the daily experiences of his inspectors and engineers such incidents as will act as sign posts to warn users of electrical machinery of the many pitfalls which experience alone can teach them to avoid. His report for the year 1905 was issued recently, from which the following interesting points are taken:

The report shows a large increase in the company's business accompanied by a still larger increase in claims. The explanation suggested is the deterioration of electrical machinery by age and use. At the same time it is believed that the heavier fuses which the insurance company has been compelled to allow to meet the heavy starting currents required by motors in so many cases are not without influence on the rate of breakdown. This rate among dynamos is decreasing, but among motors, particularly small motors, it is increasing, and somewhat rapidly increasing. In 1905 it was no less than one in eight, which means that every eighth motor insured broke down within the year. Among dynamos it was lower. The rate among continuous-current motors exceeded the rate among alternating-current motors by forty per cent, while the rate among alternating-current dynamos exceeded the rate among continuous-current dynamos by twenty-nine per cent.

The proportions in which the various parts of the machines are thought to have given way are set out in the following tables:

	Dynamos. Per Cent.	Motors. Per Cent.
Armatures and rotors	53	48
Magnet coils and stators	6	13
Commutators and brush gear	25	28
Miscellaneous	16	11
	100	100

STARTING SWITCHES AND CONTROLLERS.

	Per Cent.
Resistance coils	48
Contacts or switch arms	15
Automatic apparatus	13
Miscellaneous	24
	100

And the causes of the breakdowns were probably the following:

	Dynamos. Per Cent.	Motors. Per Cent.
Accident	15	9
Dirt and neglect	14	19
Age and deterioration	21	25
Bad workmanship and design	23	18
Overloading	0	2
Unascertained	27	27
	100	100

STARTING SWITCHES AND CONTROLLERS.

	Per Cent.
Accident	22
Dirt and neglect	11
Age and deterioration	23
Bad workmanship and design	9
Improper use	7
Unascertained	28
	100

The following reports of breakdowns are particularly interesting:

A continuous-current forty-eight kilowatt motor transformer, with double-wound armature receiving current at 1,000 volts, and generating at 115 volts; one of several placed in different substations to feed a low-tension network.

In ordinary working the field magnets were excited by current shunted from the low-tension brush leads, but for starting purposes there were also a fairly large number of coils in series with the high-tension circuit, which were automatically cut out by a "stray-field" switch, when the excitation was complete. There was also an automatic single-pole switch on the low-tension side for connecting to and disconnecting from the low-tension cables.

The high-tension cables were protected by double-pole fuses at the generating station. One day these fuses melted, indicating some fault in the system, which was afterwards found to be a short circuit on the mains supplying the transformer.

A man was at once sent to the substation. He found the transformer running at an excessive speed and stopped it, but not before the binding wires had been broken and the end connections to the armature spread by the centrifugal force, so that the armature had to be entirely rewound.

There was some uncertainty as to the cause of the mishap, but after getting all the information obtainable the insurance company came to the conclusion that when the high-tension current was cut off by the melting of the fuses and the machine began to run as a motor with current from the other transformers, in connection with the low-tension network, and to deliver current to the short circuit created by the fault, the current taken from the low-tension mains would be so great as to cause a heavy momentary fall of potential in these mains, and in the shunt, which would demagnetize the field sufficiently to throw out the "stray-field" switch and throw in the series windings. These opposing the effect of the current in the shunt would permanently weaken the field, and allow the armature to attain a speed sufficient to cause the damage above described. This conclusion was supported by a very important fact not hitherto mentioned. The automatic switch on the low-tension side was out of order and failed to fall out at the moment the current was reversed. Had it acted as was intended, the machine would have been switched off the low-tension mains when the fuses on the high-tension cables melted.

A semi-enclosed three-phase alternating-current motor, taking eighty-five amperes per phase at 350 volts, driving shafting in an ironworks. In consequence of persistent melting of the fuses the inspector was sent for to ascertain the cause. On testing for insulation he found the stator windings earthed. As far as could

be seen through the openings in the front cover of the casing everything appeared to be in order, but on taking off the cover at the pulley end, which was unprovided with inspection holes, and taking out the rotor, the cause of the trouble became evident.

That end of the machine was saturated with oil and covered with dust, and the stator windings were burnt in many places by arcs caused by temporary short circuits. Their condition was so bad that the stator had to be entirely rewound. The oil had come from the bearing at the pulley end of the rotor shaft. This bearing was partly inside the casing, and the mouth of its overflow pipe was placed so high that the oil well could be almost filled with oil. This, combined with an inefficient guard over the oil thrower and the high speed of the shaft, 750 revolutions per minute, allowed the oil to creep along the shaft and to be thrown on to the windings of the motor.

There seems to be a somewhat widely-held impression that alternating-current motors can not be damaged by oil or dirt. As regards the rotors there is some excuse for the belief, because the difference of potential between the windings themselves and between the windings and the frames is low, and therefore imperfect insulation may be sufficient to confine the current; but as regards stators the only advantage they have over the armatures of continuous-current machines is this, that they are stationary, and therefore their insulation is less liable to disintegration and will hold out longer in a deteriorated state than if it were subject to the vibration of a moving part.

The above is quite a typical example, twenty-three per cent of the failures of alternating-current motors in 1905 being due to this same cause.

A continuous-current, series-wound, four-pole motor, rated at four horse-power when running at 600 revolutions per minute with current at 220 volts. The motor drove the longitudinal traveling motion of a ten-ton crane. It was placed below one end of the girder, which had a span of about thirty feet, and was coupled to the driving shaft by gearing. The armature shaft broke at an abrupt change of diameter. The armature dropped upon the pole pieces, which tore off the binders and damaged the insulation of the conductors. As a previous shaft had been broken in an exactly similar way a year before, the owner decided to alter the design.

Some tests were made after the new shaft had been put in to ascertain the starting and working currents with the carriage carrying the motors for the lifting and cross traverse in three different positions—at the same end of the girder as the driving motor, half way along it, and at the end farthest from the driving motor. The results are given below:

Position of Carriage.	Starting Current. Amperes.	Working. Current. Amperes.
Same end as driving motor	25	15
At middle of girder.....	30	15
At end furthest from driving motor	35	15

The experiments were repeated with a weight of five tons hanging from the carriage, with very similar results.

It is not quite clear why the starting current increased with the distance of the carriage from the driving motor. The most probable explanation seems to be that the cross shaft which drove the wheels at the end of the crane furthest from the motor was weak and twisted, so that the wheels next the motor began to revolve before those at the far end of the girder and thus caused one end of the girder to advance before the other, throwing the wheels athwart the rails. As the twisting of the cross shaft would depend on the inertia of the mass to be moved it would be greatest with the carriage at the far end of the girder. When the driving motor is geared to the middle of the driving shaft the tendency to slew the girder is not so great.

The breakage of the shaft must be attributed to the weakening effect of the abrupt change of diameter, for with the highest starting current the stress would not have exceeded 3,400 pounds per square inch.

A common cause of damage to the field coils of shunt-wound motors and to the no-volt release coils of starting switches, is high voltage generated by induction on breaking shunt circuits.

Berlin Street Lighting.

The different systems of street lighting in Berlin is the subject of a letter from Consul-General A. W. Thackara. He writes:

"An English company which secured the charter eighty years ago for providing Berlin with gas continues in active operation, competing, however, with municipal gas works established later. The prices of gas have been reduced several times, and now stand at eighty-three to eighty-seven cents per 1,000 cubic feet for lighting and eighty cents for cooking and for power. These price reductions lessened the profits of the gas works; nevertheless, profitable results have accrued to gas-works operations. For the fiscal year 1903 (the latest figures obtainable) the value of the municipal plants totaled $24,564,000 and the receipts were $7,085,896. The actual amount of loans on the plants were $10,111,893, and $425,854 was required for paying interest. Other expenditures were $305,679 for redemption of debts and $5,192,203 for working expenses, leaving a net balance of $1,159,780. In addition to the three city gas works now in operation, which can produce about 1,000,000 cubic meters every twenty-four hours, a new large gas plant is in construction which will produce 780,000 cubic meters per day, and a plot of ground has been purchased on the Upper Spree for a similar gas works. That the municipal gas works is regarded as a commercial concern is proved by the fact that the contracts for the delivery of gas made with the public are considered as contracts according to civil law, like any other contract made between a merchant and his customer. The different systems of street gas lighting are the inverted Welsbach lights and the Erich and Gratz, each of which consumes 100 liters every hour, the upright Welsbach lights, which consume about 125 liters, and the Millenium, which consumes nine-tenths of a liter per Hefner candle.

"The supply of electricity for lighting and industrial purposes has for many years been in the hands of a private company, which is bound to light the streets at the same price charged for industrial purposes, which is 3.8 cents per kilowatt-hour. Moreover, the company has to pay the city treasury 10 per cent of its gross proceeds and to give it a share in the clear profits of its business. If the clear profit exceeds six per cent of the joint stock up to the amount of $4,760,000 the company must pay fifty per cent of the clear profit; should the joint stock be augmented beyond $4,760,000, fifty per cent must then be paid of the clear profit that exceeds four per cent of the capital. Although this contract grants to the company the right to use the streets for electric conduits it provides that competition shall not be excluded. The municipality shall also be entitled in 1915 to claim that the whole electric plant shall pass into its hands on payment of the estimated value.

"For the fiscal year 1903 the Berlin electric works paid to their shareholders $569,772 and a total to the municipality of $677,419. This is an excellent comparison with the 1899 figures, when $449,820 went to the shareholders and a total of $368,630 to the municipality. For lighting purposes the cost of electricity in Berlin ranges from 7.6 to 9.5 cents per kilowatt-hour. Between the hours of 10 P. M. and 6 A. M. the rate is 7.14 cents. For industrial power purposes the rate is 3.8 cents per kilowatt-hour."

THE NEW MUSPRATT LABORATORY OF PHYSICAL AND ELECTRO-CHEMISTRY AT LIVERPOOL UNIVERSITY.

BY JOHN B. C. KERSHAW, F.I.C.

The new laboratory for the study of physical and electrochemistry which has been built in connection with the University at Liverpool, is the gift of E. K. Muspratt, of Seaforth Hall, a member of the old Lancashire family of alkali and chemical manufacturers.

The building with its equipment is likely to cost between £15,000 and £16,000. The original sum offered by the donor was £10,000, but the extra cost of the laboratory is to be borne by Mr. Muspratt, who has been anxious to render the building and its equipment one of the most complete in this country for the study of physical and electrochemistry.

The new laboratory has been erected upon a plot of ground behind the existing chemical laboratory of the University in Brownlow street; and is a striking building of four stories of red brick and stone, surmounted by four stone cupolas which serve as draught exits for the ventilation of the building.

The plan of the laboratory may be gathered from the following details of the rooms, etc., upon each of the four floors:

The basement contains a dynamo room, battery room, store, furnace room, and extra research room, to accommodate four students.

The ground floor contains lecture rooms, accommodating eighty to ninety students, library, workshops, preparation room, and photographic room.

The first floor contains the elementary laboratory, accommodating twenty-one students, optical room, instrument store room, research room for members of staff, research room accommodating two students, and balance room.

The second floor contains the senior laboratory, accommodating eight students, research room for members of staff, research rooms accommodating six students, and balance room.

The roof contains the lavatory, distillation room, store and small roof laboratory.

It will be seen, therefore, that the laboratory contains good accommodation for about forty-three persons.

The benches are supplied with gas, water, and electricity, but not with vacuum, compressed air, or steam. Close to each working bench is a fire-proof slab, composed of compressed red Ruabon tiles, set in cement. This material is used throughout instead of slate, except for supports for balances. For the floors of fume-chambers, slabs of white glazed fireclay are employed. The fume chambers are ventilated by separate shafts of glazed earthenware pipe—the draught is obtained by gas burners. The same system is employed for the general ventilation of the rooms, mechanical ventilation by exhaust fans being considered unnecessary. The floors are constructed of concrete carried by steel joists and girders, and are covered with a layer of coke and cement, to which the wooden flooring is nailed. In the basement the floors are finished with cement and granite aggregate. The waste-channels are set in the concrete, and are constructed of sections of glazed Doulton half-piping, jointed with cement protected by china clay and pitch. The walls are finished with plaster, the ceilings with Portland cement, both walls and ceilings being provided with wooden fixing battens. Rooms intended for ordinary teaching work are fitted with working benches of the usual type, but several of the research rooms are arranged for movable tables, so as to permit of greater flexibility.

The main lighting is effected by brackets or pendants carrying incandescent gas burners, but the fume chambers and certain rooms are lighted with tantalum electric lamps.

Current is supplied from the town mains at 460 volts, and this is employed to drive the motors of three direct-coupled motor-generators, arranged as follows:

(1) A thirty-kilowatt direct-current generator, supplying current at 80 to 100 volts.

(2) A ten-kilowatt charging set, consisting of two machines on the same axle, each giving 250 amperes at twenty volts.

(3) An eighty-kilowatt alternator, with two windings, to give 1,000 amperes at eighty volts or 500 amperes at 150 volts.

The charging set is employed to charge (in sections) a battery of thirty-six Tudor cells, arranged in six sets of six cells. Vertical cables carry the current from the generators (1) and (3) and from the cells to four distributing exchange-boards arranged on each floor. Each working bench is provided with a circuit to carry fifty amperes running to the corresponding distribution board. Here, by means of flexible connections, the bench circuit can be connected up with the various voltages.

Three wires run from the battery switchboard to each of the three exchange boards, and by means of flexible connections, each of these sets of three leads can be connected up on the battery switchboard so as to supply each exchange board with current at four, eight and twelve volts. To secure greater constancy of voltage, the battery is divided up into six cells, so that each floor may have the use of a separate set of cells. Arrangements are also made whereby the cells may be put into series or parallel for special purposes. In order to obtain relatively heavier current at lower voltages, a cable to carry 1,000 amperes is run from the battery switchboard to the room intended for furnace operations. The cable and wires which are not rubber-insulated, are run on porcelain insulators attached to the walls and ceilings by wooden battens, so that all wiring is exposed. To reach centre benches the wires are dropped from the ceiling to the bench, so that no wires are carried in the floors. In addition, the benches are supplied with ten-ampere plugs connected with the 230-volt town mains. The wiring of these is rubber-insulated and enclosed in wooden casing. The fuses for the plugs and bench circuits are situated at the top of the exchange boards. The panels of the latter are of marble, whilst the terminals at the benches are fastened to slate panels.

The architects of the new laboratory are Messrs. Willink & Thicknesse, of Liverpool; the electrical machinery is being supplied by Messrs. Siemens Brothers, of London; while the wiring and switchboard work is being carried out by H. S. Martin, of Liverpool. The British Insulated and Helsby Cable Company supplied the cable and distributing wires.

The formal opening of the laboratory took place on Saturday, October 13. Dr. F. G. Donnan has been appointed professor in charge of the new laboratory.

The Alaskan-Yukon-Pacific Exposition of 1909.

A $10,000,000 fair—the Alaskan-Yukon-Pacific Exposition—is announced for Seattle, Wash., in 1909. It is stated that $650,000 has been raised through the sale of stock in the exposition corporation. This will be primarily an Alaskan fair, held to exploit to the world the resources of this territory. It is expected that a most remarkable collection of mining exhibits will be shown. The Washington University grounds, comprising 355 acres bordering on Lake Washington and Lake Union, have been chosen as a site, and landscape gardening will soon be begun. The site is twenty minutes' ride from the centre of the city.

HANDLING PUBLIC COMPLAINTS.[1]

BY JOHN A. BEELER.

To deal with the traveling public without developing undue friction is one of the most perplexing problems which daily confront a street-railway manager. While ninety-nine out of every 100 persons who patronize the street cars will do so, month after month, without the slightest trouble, the other individual, who "don't like corporations, anyhow," often boards the car with the hope that something may occur which will ruffle his feathers and give him the much-longed-for opportunity of giving the company or its employés a piece of his mind.

On the other hand, it must also be admitted that employés are sometimes overbearing in their conduct toward passengers, surly and impertinent in giving answers to questions, and slow to render assistance and perform acts of kindness which tend to increase their popularity and make friends for the company. The superintendent can not long remain ignorant of the methods of such men. If not detected by other means, it is certain that many complaints will be recorded against them, and if their habits of action can not be corrected they must speedily be eliminated from the service. Many a complaint of comparatively trivial nature could easily have been forestalled and the patron satisfied had the employé concerned exercised a little diplomacy in dealing with him. While many conductors and motormen often exhibit this faculty to a remarkable degree, others seem utterly devoid of any power to enforce the company's rules without giving offense, and it is against the latter class that nearly all the complaints are made. A man who has no tact can not get along with passengers, and such a man is sadly misplaced when he attempts to act as a conductor.

Many and varied are the complaints and grievances. Some of them are sublimely ridiculous, while others are weird, a few highly dramatic, and occasionally we hear one which even borders on the tragic. For an instance of the former, there is a woman who lives out in a suburb; it is not a thickly settled community, and, as is often true of such districts, the residents are strenuous in their efforts to become familiar with each other's doings. The woman comes into the office greatly disturbed and angry. She has a hunted look, and with bated breath informs us that her neighbors are talking about her in a most cruel manner. When she passes by, they look at her out of the corners of their eyes, shake their heads knowingly and make veiled insinuations that she is not just right. They even gossip with the conductors on her line and have enlisted their sympathy, and while none of the car men have actually spoken to her, nearly all have glared unutterable accusations at her. They look at her when she is getting on the car, they stare at her as she sits in her seat minding her own business and speaking to no one. They observe her actions when she is alighting, and actually watch to see where she goes. She can not endure this treatment any longer, and something must be done at once. She wants the company to correct and discipline its employés. The poor scribe, with patience born of long suffering, assures her that something shall be done to divert these annoying glances, and he hopes she will experience no further trouble, while inwardly he wonders what is wrong at the box-office in her roof garden.

Another pathetic case is that of the forlorn maiden who has handed the conductor a five-dollar gold piece, thinking it was a nickel. It was all the money she had, and the big hot tears are overflowing into briny rivulets as they trickle unchecked toward a bright red spot at the end of her little nose. Her woful countenance would evoke pity from a placid wooden Indian. She can remember on what line she was a passenger, and is sure that it was somewhere between half-past eight and a quarter after nine o'clock. Can't the company refund her four dollars and ninety-five cents, and collect the money from the conductor? The man, in sympathetic tone, assures her that he will cause an immediate enquiry to be made of conductors who passed a given point between half-past eight and a quarter after nine, and will make every effort to recover her money. During all this conversation he is harassed by a painful recollection of a time when his sole wealth consisted of a solitary V, and, try as he may, he can not imagine any combination of circumstances that could have resulted in his even dreaming that it was only a nickel.

Here comes an elderly woman with rotund figure. If you meet her in the hallway you will notice that her features wear a look of savage determination. As she enters the office, it is clearly seen that all her sensibilities of right and justice have been grossly outraged. She is visibly angry. She singles out the young man with the gazelle eyes, and with a commanding frown over her spectacles that brings him to his feet, and says to him louder than words, "Insignificant hireling of a greedy monopoly, approach me?" she begins. "Young man, I want to see the general superintendent, personally." "The superintendent is out, madam, and may not return for an hour or two." "Well, I have no time to wait in this office—I want justice, that's what I want." "Madam, the superintendent sometimes entrusts me with the taking of complaints. Can I be of any service to you?" "Well, if I can't see him, I suppose you will have to do, but I want you to tell him what I said just as soon as he gets back. I have ridden on your cars for the past fifteen years, and I and the members of my family have paid your company hundreds of dollars. Yesterday I was on a car and handed the conductor a dollar to pay my fare. When he gave me the change, there was a quarter with a hole in it." "Did you call his attention to it, madam?" "No, I did not; in fact, I didn't notice it at the time, but I know your conductor gave it to me, because I hadn't changed a bit of money anywhere else. To-day, I got on a car and handed this quarter to another conductor, and d'ye think he'd take it? Not he! The impudent rascal refused it! I said to him, 'that's a nice way to beat a poor woman! I got that quarter from a street-car conductor yesterday, and now, when I offer it to you to pay my fare, you won't take it! Young man, you may think that's clever, but I don't!'". "Madam, can you identify the conductor who gave you the mutilated quarter?" "No, I can't. I didn't pay much attention to what he looked like, but I know he gave it to me, and I think it's a shame that I can't get another quarter for this one. Such robbery ought to be exposed in the newspapers. I am going to see if I can't get justice somewhere!"

Here comes a tall, thin man, who speaks in a high voice. From his appearance it is evident that he is no spendthrift. He holds a transfer in his hand. The issuing conductor punched out the wrong line, and when he boarded the connecting car, the other conductor asked him for an additional fare—manifestly a base imposition for the purpose of securing two fares. He cares nothing about the nickel, mind you, but the principle of the transaction he can't endure, and will not allow it to pass without protest. When he called for the transfer his falsetto effort no doubt sounded to the conductor, above the rumble of the car and the roar of street

[1] A paper read before the American Street and Interurban Railway Association, Columbus, Ohio, October 18, 1906. Mr. Beeler is general manager of the Denver City Tramway Company.

traffic, something like the name of the line that he punched, and instead of making enquiry, as he should have done, punched the line, as he was in a hurry, taking for granted that it was right. The thrifty one in such case is generally satisfied with a return of his fare and a little "regretting" on the part of the man; but the latter can not help speculating as to whether in all his past travels there never were any occasions upon which the conductors failed to get his fare, and thus compensated this downtrodden individual many times for his loss.

Then there is a nervous lady who rushes into the office, trying to tell, between gasps for breath, about a horrid mean conductor—she didn't think to take his number, but he is on the car that just passed the office—who gave her only forty-five cents in change for the dollar she handed him. She is sure that it was a dollar, because it was every bit of change she had. There was a woman sitting in the seat beside her, and she is sure this woman would swear to the value of the coin, but in her excitement she forgot to ask her name. The conductor insisted that she gave him only fifty cents; but she guesses her reputation in the community is such that if she says it was a dollar, that is sufficient, and the evidence against the conductor is conclusive. After being assured that an immediate investigation shall be ordered, she is somewhat mollified, and is willing to await the turn of events. When balancing his cash, the conductor sometimes finds that he is fifty cents over, and readily admits his error. In other cases the lady has the courtesy to inform us that she found the coin under her powder-box on the chiffonier at home—she very much regrets, etc.

And so the daily pantomime continues, and will no doubt continue as long as street cars are operated by human beings. Happy the individual who can, month after month, listen sympathetically to the grievances and lamentations of the traveling public, and yet find enough humor therein to act as a nerve tonic, help to lay the foundation for an angelic temperament, and not disturb his digestion.

In cases similar to that cited in the last instance of complaint, we find that the plan of filing papers pertaining to each employé in a separate folder, which will be described hereafter, is a particularly advantageous one. If a conductor is using the "short change" method for gain, such fact, if not otherwise detected, will soon become evident from the numerous protests of passengers that will accumulate in his file. There is no doubt but that tricks of this nature have been perpetrated to some extent in every city. Conductors have been known to openly boast that they took advantage of a certain class of passengers whose sight was poor, who were slightly under the influence of liquor, or whose attention was otherwise taken up. Unprincipled conductors have also been known to carry a supply of Mexican coins, and to work them off when giving change to this same class of patrons.

In Denver all complaints, unless manifestly absurd, are carefully investigated by the management. When a written complaint is received, it is at once acknowledged by a courteous note stating that the matter will be thoroughly investigated. The standing of the party who makes complaint or the evidence of sincerity with which it is written is taken into consideration. The party is thanked for calling the company's attention to the matter, and if the information contained seems insufficient, further information along indicated lines is requested. We find that parties making written complaint usually have had some just provocation, for by the time the party complaining has gotten home or arrived at his office and penned a note, he has generally cooled off to an extent sufficient to either give a clear account of the trouble, or entirely ignore it and not make complaint. Very little attention is paid to anonymous complaints.

A printed form for complaints made in the office has been in use for some street-railway companies. It is known as a "complaint card." One side of the blank is devoted solely to the statement of the complainant, who is required to write the same over his signature. The other side is reserved for the division superintendent or special investigator, who writes thereon the result of his investigation and his recommendations; and below this there is also a space for the judgment and final action of the superintendent. While this method seems very concise and complete, we find that while many persons who wish to register complaints have rehearsed the incident or accident so fully in their own minds that they can relate all the harrowing details if subjected to a little judicious questioning, yet, in their excitement, when they undertake to write their statement, seem to think they have conveyed all the particulars in a few disjointed sentences. Some persons have the ability to express themselves on paper, while others have not. From our experience we believe that the best plan is to have the complainant make his report to a competent stenographer, who is well enough posted to make proper enquiries and draw out information which may be needed to make it complete. The complainant may be required to sign the typewritten record, if thought necessary or advisable. In this manner we may render material aid to those who are required to make the investigation.

After passing out of the stenographer's hands the complaint is laid before the superintendent of transportation, who will, unless immediate action becomes necessary, refer it in turn to the division superintendent. It may be found more prudent to withhold the complaint from the employé against whom it is registered, and require him to write the details of the alleged occurrence from his own viewpoint, giving also the names of any witnesses that may have been secured on the car. After gathering all the information possible, the division superintendent returns to the superintendent of transportation the statement of the employés, together with all the papers in the case, and also adds his findings and recommendations. If names of any witnesses have been furnished by the employé or complainant, the superintendent of transportation will communicate with them, unless he has already fixed the blame. At the completion of his enquiries, he issues such orders for discipline as his judgment may dictate. No matter what other action may have been taken in cases of complaint wherein employés have been found at fault, the details are briefly written in their records, together with the final disposition of the matter.

For filing complaints we use the ordinary vertical cabinet file, with folders of light cardboard, similar to those used for correspondence. The folders are numbered to correspond with the numbers of employés' badges, so that it becomes a simple matter, when reviewing a man's record, to open the cabinet and take out the folder containing the complaints and other papers bearing on his past conduct. Should it become necessary to call an employé into the office for discipline, the superintendent may, in a few moments, examine his record card and folder, and quickly form his judgment as to such employé's future value to the company.

Briefly our aim has been, as far as possible, not to antagonize the public in any manner, but to rectify all mistakes and make an apology for all incivilities on the part of our employés; to correct such tendencies, especially those of impudence and impertinence, to pour oil on the troubled waters, and adopt Denver's motto of "Smile and Push" for the company.

An Electric Car Brake.

To the Editor of the Electrical Review:

I was very much interested in reading your editorial in the issue of October 6, on the report of Director Scholtes concerning electric and air brakes for trolley cars. I fully endorse the views expressed by Director Scholtes.

The experience with the Pfingst Electric Brake on a Broadway and Columbus avenue car of the Metropolitan Line, for forty days commencing July 23, of the present year, shows conclusively that this particular electric brake could handle a car with absolute safety, and make easier and better stops than with the air brake, and at the same time there was no limit to the number of applications which could be made within a given time, as there is with the air brake. There is a limit to the number of applications which can be made with the air brake and I am informed that one of the reasons why the air brake was taken off the Third avenue line was because a sufficient amount of air could not be stored to be absolutely sure at all times.

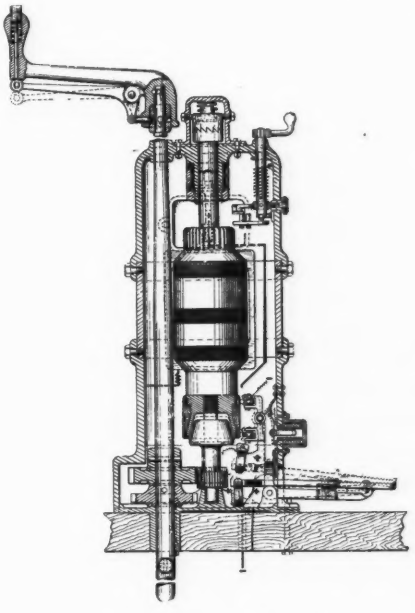
The Pfingst Electric Brake is constructed as follows:

The motor as shown in the accompanying illustration is constructed around the brake spindle, and this brake spindle is connected at the bottom through a mechanical clutch with gearing which operates the brake spindle at the bottom and to this brake spindle is attached the ordinary brake chain, which should, for safety, be double.

A simple controller, with a handle, similar to the air brake, applies the power. This controller is held "clear" of the contacts by the motorman and the removal of his hand causes the controller to force the brake instantly into "emergency" application and the brake is applied with the full force of the trolley current. A "service" application is controlled by the resistances in connection with the contact points on the controller so that any amount of power can be applied. The releasing of the brake is affected by pressing a foot pedal which is connected with the mechanical clutch by means of a collar around the shaft; this collar being fitted with roller bearings so that the releasing is very quick and absolutely noiseless.

With this arrangement the hand brake is always ready for use and the handle is operated by a ratchet in the usual way. While the brake is being applied with power the hand brake handle remains absolutely stationary. This is accomplished by means of a collar around the shaft. All of the power thus applied, is held by a roller jamb against the shaft at the top so that the motor always runs in one direction, and when the brake has been applied the power can be taken off and the brake will remain applied indefinitely, or until the foot pedal is pressed and the mechanical clutches separated. The mechanical clutches are always engaged and ready for action, therefore the brake is absolutely automatic.

This patent covers application on two or more cars. The circuit is so arranged that if the cars separate and current is carried on the following cars, the brakes will be applied in the emergency application at once. The application of the brake on one or more cars is controlled



Pfingst Power Brake.

by means of the controller on the forward platform, and the clutches are separated by means of solenoids.

The Broadway car on which this device was placed, was a steel car weighing over twenty tons, and was run in daily service operated by motorman Michael Spaulding, who felt his work was reduced fully seventy-five per cent, and that all anxiety about striking teams or persons was removed. The easy stops made by the car were so very pronounced that a great many men who boarded the car questioned the conductor and the motorman as to what kind of a brake they were using. There was absolutely no surging of the car in stopping, and yet if a quick stop was necessary, it could be made. The absence of surging is due to the fact that the brake can be released instantly by the pressure of the foot on the pedal. This, of course, can not be accomplished with the air brake, as the air must escape from the cylinder before the pressure can be relieved on the wheels.

This brake changes nothing underneath the car. The foundation brake remains the same as at present. It can be placed on any wooden car within two hours, including the wiring of the car.

Mr. Scholtes' position was criticised by his associates because the electric brake is not considered as available if the current should fail. One of our patents shows a connection through one of the car motors to the controller on our brake device, with the connection reversed on the motors, so that if the trolley current fails, the circuit of the car motors can be passed through a resistance of fifty ohms, which will cause a short circuit of the motor, and this "bucking" will quickly bring the car to a standstill. As these connections are passed through fifty ohms, it will not cause any damage to the motor. The contacts for these motor connections on our controller are in such a position that it is almost impossible for a short circuit to be made while the trolley current is on.

J. B. Stewart.

338 South Station, Boston, October 13.

New York Electrical Society.

The 262d meeting of the New York Electrical Society was held at the Edison Auditorium, October 31st. Professor V. Karapetoff, of Cornell University, delivered an address on "The Human Side of the Engineering Profession." Professor Karapetoff defined the principal requirements for an efficient engineer, and gave some valuable hints as to acquiring the necessary qualifications for securing a commanding position in the engineering field, by study, observation and the training of the character. He also showed many of the factors which stand in the way of success. The lecture was full of interest and at its close the lecturer was greeted with prolonged applause.

Exposition of Safety Devices.

The American Institute of Social Service announces considerable interest in the exposition of safety devices which it will hold in New York city, January 28, to February 9, 1907. Prominent Americans and quite a number of European authorities have pledged exhibits. Requests for information concerning this exposition should be addressed to Dr. William H. Tolman, director, 287 Fourth avenue, New York city.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

Radium and Geology.

A reply is made here by R. J. Strutt to O. Fisher's comments on the former's suggestion that the heat of the earth may be due to radium. These comments were noted in the ELECTRICAL REVIEW for November 3. In them Mr. Fisher pointed out that apparently the theory left no room for that shrinkage of the globe required by geological theories, and which is generally attributed to cooling. Strutt's contention is that the production of radium from uranium, and the decomposition of the former, are changes which may themselves cause the shrinkage believed to be taking place. It is probable that radium is widely distributed throughout the earth's crust, and the fact that it is never given as a constituent of rocks may be due to its small proportion, as the quantity is of the order of one one-hundreth per cent. Mr. Strutt also replies to a point raised by B. J. Palmer, that, arguing from analogy, if the heat of the earth be due to radium, we should be led to the conclusion that the moon is not a cold body, and must possess internal heat. Mr. Strutt points out that the absence of volcanoes is no proof of the coolness of the moon, for volcanic action is due to the presence of highly heated steam, and the absence of water on the moon would account for its quietness.—*Abstracted from Nature (London), October* 18.

Economical Importance of Gas Engines in Generating Stations.

A discussion of economies to be effected by the means of gas engines was presented by E. A. Ziffer to the recent railway congress in Milan. The author first gives in some detail the different systems of producing power gas, then gives some interesting figures showing the relative cost of power when obtained in different ways. He estimates that allowing two cents per kilowatt-hour, and seven and one-half per cent for interest and depreciation, that the annual cost of running a twenty-five-horse-power motor is $1,050. For a 100-horse-power motor it would be $4,170. The cost of operating two steam engines with similar ratings is estimated as follows: For the twenty-five-horse-power engine $867, and for the 100-horse-power engine $2,487. This is figured on the basis of about five pounds of coal per horse-power-hour, and with coal at $3.00 per ton. Interest and depreciation is taken at ten per cent. For a gas engine with gas at two cents per cubic meter, the annual cost for a twenty-five-horse-power engine is estimated at $695, and at $2,320 for a 100-horse-power unit. Using producer gas the cost for a twenty-five-horse-power gas engine is found to be $347, and for a 100-horse-power engine at $1,194.—*Translated and abstracted from L'Electricien (Paris), October* 20.

Increasing the Constancy of Batteries Giving Currents.

The use of storage batteries to steady the voltage of electrical supply systems has suggested to W. P. White that a similar plan might be adopted with a set of batteries in order to maintain a constant current or a constant voltage of delivery. The plan adopted consists in placing in two parallel circuits two batteries, or sets of batteries, one having a somewhat higher voltage than the other. In each circuit is placed a resistance, and by properly adjusting these two resistances the potential at the terminals of the circuit containing the lower electromotive force may be maintained equal to that electromotive force due to the current delivered by the other circuit. Under these conditions the system will maintain a constant voltage, or, if connected to a third circuit having a constant resistance, will deliver a constant current. While variations in the voltage of either of the batteries due to discharge may cause a slight unbalancing of the system, the effect upon the voltage or current delivered will be considerably less than the cause itself. The system is not intended to enable primary batteries having poor discharge characteristics to operate at a constant potential, but is rather intended for making still more constant the voltage of constant potential cells such as storage batteries. The plan is best suited to batteries with low internal resistance, and in particular it is suited to giving constancy in the main current of potentiometers of very low resistance. —*Abstracted from the Physical Review (New York), November.*

Platinum in the Yukon.

Platinum was discovered in the black sand residue obtained along the Teslin or Hootalinqua river, Yukon Territory, as early as 1898, but until recently no active preparations have been made to recover it. The river named is one of the southern tributaries of the Yukon. Its gravel bed carries gold in payable quantities, even by hand-working. Throughout its lower part the river is wide and shallow and has a sluggish current. Black sand from this river was treated by the United States Geological Survey's plant at the Portland (Ore.) exhibition of 1905, the opinion reached being that the platinum, although exceedingly fine, is capable of recovery. From ten ounces of black sand taken at random from a gold washer, sixty cents' worth of platinum was recovered. A more recent test on fifteen ounces of black sand recovered from 200 pounds of original gravel gave 0.7 gramme of platinum and 0.023 gramme of iridosmium. A dredging syndicate is now preparing to work the sands of the river, with the idea of extracting the platinum. Concessions covering fifteen miles up the river from its mouth have been secured, and the necessary machinery can be readily carried there by rail. This would be the first attempt to recover the platinum in the far north.—*Abstracted from the Engineering and Mining Journal (New York), October* 27.

Heating of Underground Cables.

A recent investigation conducted by Professor Mie of the heating of underground cables is discussed here by R. V. Picou. In order to simplify the analytical consideration Mie adopts the idea of an equivalent radius of cable, that is to say, he substitutes for a two or three-conductor cable a single conductor cable which he computes produces the same conditions in the external surroundings. For this purpose the approximate formula used by Teichmüller and Humann is employed. A further assumption is made that the surface of the ground is an isotherm. This assumption may be questioned, but it simplifies the question considerably as it enables the problem to be treated by the method of images. The experiments were

conducted by surrounding the cable with sand and adding to this different percentages of moisture. It was found that the relation between specific resistance, r, measured in electrical units to thermal conductivity, k, in thermal units, is given by the equation $k = \frac{0.24}{r}$; the mean value of r was found to be 650 for simple cables and about 600 for multiple cables. This gives a value for k nearly ten times greater than that which has heretofore been assumed. For this reason it is necessary to take into consideration in such studies the character of insulation on the cable itself. It was found that the condition of the soil affected enormously the heat conductability, for the specific resistance expressed electrically was found to be 322 with sand containing one-half per cent of moisture. With 4.4 per cent of moisture the specific resistance had fallen to eighty-one, and with 9.9 per cent of moisture it was sixty-two. For earth with a percentage of moisture of twelve, the specific resistance was 117. These studies show that in order to predetermine the heating of any particular cable it is necessary not only to know the character of its insulation, but that of the soil through which it is to be carried as well. The author suggests that it would be advisable to carry out new experiments in this important subject since the results here discussed differ so greatly from previously-held ideas.—*Translated and abstracted from L'Industrie Électrique, (Paris), October* 10.

Locomotives versus Motor Cars.

The comparative merits of locomotives and motor cars for railway work are examined here by C. F. Street. Local conditions must necessarily have an important bearing on the problem, and, in general, the following rules will apply: With approximate fixed weight for the majority of trains, locomotives have advantages; with a variation in the weight of trains, motor cars have advantages, which increase in proportion to this variation. The advantages of locomotives are a smaller number of parts to be inspected, and these are more accessible. The number of cars in service can be changed at any time, and without regard to whether they are fitted with electric wiring. When the number of cars in a train must vary, the motor cars have an advantage, since the weight of the train is reduced and the tractive effort increased; in fact, the motor-car equipment has an advantage from every standpoint. With a fixed number of cars a locomotive can be designed which will meet the tractive conditions almost as well as the motor cars, and which will have the advantages mentioned above. The author then compares the cost of maintaining steam locomotives and electric. One of the heaviest items of expense incident to the maintenance of steam railroads during the past few years has been the extension to and construction of repair shops. Some of the large steam railroads now have several million dollars in shops for making repairs to locomotives alone. The electric lines, however, have not found that any such investment is necessary for maintaining their equipments. The Interborough Rapid Transit Company, of New York city, has a repair shop of small dimensions, containing a few machine tools, all of light capacity, and giving employment to probably forty or fifty men. In this shop all the repairs are made to an equipment of 430 motor-cars, each fitted with two 200-horse-power motors, or a total equipment representing 172,000 horse-power in 860 motors. This would be equivalent to 215 steam locomotives of 800 horse-power each and it will be found that the steam road having in the neighborhood of 200 locomotives to keep in repair has shops covering many times the area of those of the Interborough company and containing an equipment of tools and machinery much more extensive and giving employment to five or six times as many men; and in addition several roundhouses, any one of which represents a greater investment than the Interborough shops. The average cost of maintaining steam locomotives varies considerably. On some roads it has been over $4,000. On thirteen of the largest railroads the average cost of over 7,000 locomotives was, for 1904, $2,212. The average cost per year of maintaining an aggregate of 7,684 motor-cars was only $107 per annum. The average cost of maintaining the steam plant, electric plant and cars, including electric equipment on these roads, was only $255 per car per year.—*Abstracted from the Electric Journal (Pittsburg), October.*

An Alternator with an Auxiliary Field for Direct Compensation for the Armature Reaction.

The reappearance of the auxiliary pole in direct-current machine design, whether it be for giving better regulation or improved commutation has suggested to A. Heyland that a similar plan might be useful in alternator design since its benefit rests largely upon the compensating effect with respect to the armature reaction. The use of an auxiliary pole seems, however, unadvisable because with low-speed alternators the cost of an already expensive design would be increased, while in the design of high-speed machines considerable difficulty would be encountered in securing a satisfactory mechanical arrangement. Some other way of obtaining the same result seems necessary. This may be obtained by compensating the exciter field for the armature reaction of the alternator since all alternators are separately excited. This may be accomplished in an ingenious way when the exciter is mounted on the main alternator shaft. The exciter has generally a less number of poles than the alternator, therefore a system of electrical compensating circuits can not be employed, but it is possible to cause the magnetic field set up by the armature so to change the exciter field as to secure the desired compensation. The plan consists simply in making use of the magnetic leakage which takes place through the alternator shaft and in securing sufficient leakage to accomplish the end sought. This is done by winding the alternate poles of the alternator field with an unequal number of turns, thus subjecting all of the north poles, say, to a greater magneto motive force than the south poles; then the pole faces of the north poles are turned off so as to give a wider air gap and thus reduce the magnetic induction there to the same density as that produced under the south poles. The two poles thus create similar magnetic conditions at the surface of the armature, but are unequally affected by the armature reactions. Magnetic leakage would, therefore, be set up by this latter effect and would pass through the alternator shaft, and can be caused to return by way of the exciter armature, exciter field and machine carcass. This leakage would normally decrease one set of exciter fields as much as it increased the other, but the same principle of construction is adopted for the exciter, one set of field poles being turned off so as to give a greater length of air gap. With this arrangement and a proper connection of exciter field the reaction of the alternator armature may be made to strengthen the exciter field, and thus to increase its voltage so as exactly to compensate for the alternator reaction upon its own field, and since this reaction will be proportionate not only to the current in the alternator armature, but to the phase relation of this current, the exciter will compensate for phase relation as well as load. In practice it will probably be found bet-

ter to adjust the alternator and the exciter fields so that there will be a demagnetization of the exciter field due to leakage when the alternator is unloaded. At about half load then the alternator will have no effect upon its exciter field, but at full load will cause an equal strengthening. The advantage of this is that to bring about a certain total effect only one-half of flux need be carried through the shaft.—*Translated and abstracted from L'Eclairage Electrique (Paris), October 20.*

Report of the Alameda (Cal.) Municipal Light Plant.

The annual report of the electric light and power system operated by the city of Alameda, Cal., for the twelve months ending June 30, 1906, has been made public. A digest of this is given in the *Journal of Electricity, Power and Gas* (San Francisco) for October 13. The plant consists of a frame power-station building containing boilers, engines and generators, the equipment being rather antiquated in type. It consists of four return-flue, fire-tube boilers, a cross-compound engine driving a generator by means of a belt, a second tandem-compound engine driving its generator in the same way, and a third tandem-compound engine direct-connected to its generator.

For the year the output of the plant for street lighting was 202,405 kilowatt-hours; for commercial lighting and power, 941,680 kilowatt-hours, a total of 1,144,085 kilowatt-hours. For commercial lighting there were in service 1,039 meters and ninety-two flat-rate consumers. The expenditures for the year aggregated $52,687.21, of which $36,455.11 was for operating expenses and $16,232.10 for new construction. The earnings of the plant were $55,746, of which $20,594.45 is credited to municipal street lighting and the remainder to commercial light and power and miscellaneous income. The new construction going on includes the installation of a new generating unit. The plant burns oil for fuel, paying from fifty-five cents to eighty-five cents a barrel, delivered. The street lights are operated upon a moonlight schedule. The investment in the plant at the time the report was made was given as $91,076.82. The total investment has been $107,317.08, from which $16,240.26 had been deducted for depreciation covering two full years ending June 30, 1906. Since May 1, 1904, the plant has been operated condensing, and alternating enclosed arc lamps have been in use in place of direct-current open arc lamps for street lighting. To these two changes is attributed a saving of 120 barrels of oil per month with the same output of plant.

Results by Telephone.

How little advertising is based on the telephone. The merchant prints his telephone number on each folder, or says "telephone orders given prompt attention." But very seldom does he send out advertising matter in which telephone orders are made the main issue.

A barber in New York city has the right idea. His shop is on Broadway, in the downtown business district, where men are in a hurry. He distributes blotters through office buildings in his territory, and about the only thing on the blotter is the suggestion "make appointment by telephone and so avoid waiting." Then follows the telephone number. This convenience requires no laudation, nor does the manner of exploiting it. They speak for themselves.

Hotels in the uptown Broadway district distribute every morning about ten o'clock a printed menu of the day's luncheon through surrounding office buildings. Business men see what's for lunch, and are doubtless often led to a particular hostelry by some special dish. But this advertising would be made much more effective if upon the menu were printed a prominent note to the effect that tables would be reserved by telephone. It might even be practicable with guests who are known to state that steaks, chops and other dishes requiring some time to prepare would be put on the fire at any desired time by telephone order, and served at the moment the guest is ready to come, thus saving what is to most people an unpleasant wait.

The grocer is a man who ought to profit by the consistent exploitation of this telephone idea. Telephones mean prosperous customers, living on a fairly liberal scale. The morning delivery service and house-to-house canvass for orders could be very materially accelerated by issuing a daily folder from which customers could order by telephone. A brief price list of vegetables, fruits and other green stuff would not be costly or inconvenient where a printing office is within reasonable distance, and the price list could be issued within two hours after the morning's stock was in, and distributed to householders in the grocer's territory. Or if this were not advisable, folders could be sent out emphasizing the fact that housekeepers have only to take down their telephone receivers any morning to learn what is in the market.

People need to be reminded that they have telephones, and shown how to use them in ordering. The telephone companies make good capital of folders that explain the uses of a telephone. Hundreds of persons would dash madly for the nearest fire-alarm box in emergency, never reflecting that the telephone is the quickest of all fire-alarms, did not the companies remind them of it in advertising. Every telephone order received puts the cost of selling on the customer, who pays for the message. What is needed is advertising matter that will make this telephone issue prominent. Readers should be impressed with the idea that the telephone is there in their own homes, and that messengers wait at the store to carry out any order they may send in. The druggist should educate his neighborhood to the speed, ease and advantages of the telephone in sending emergency calls for medicine. The physician would find this an unobjectionable form of advertising. The bank can get deposits by telephone, sending a messenger for them on request. The department store should make its daily bargains accessible by wire. Telephones are universal nowadays. They have a universal application to business. But the public is blind to many of their uses, and needs to be reminded by special telephone arguments.—*Printers' Ink.*

Electrically Lighted Railway Mail Cars.

The committee appointed by the Railway Mail Agents at their March meeting at Portsmouth, N. H., to draw up resolutions expressing the opinion of the executive committee as to the proper manner of running and lighting railway postal cars, passed a resolution that "in a great number of instances mails have been either delayed or totally destroyed, cars either totally damaged or destroyed, and the loss of some of the twenty-one of our fellow clerks killed in the line of duty during the past year is chargeable to the use of Pintsch gas as an illuminating material." The committee considers that "it is imperative for the public interests and the safety of the postal clerks that the existing requirements of the post-office department wherein railway companies who furnish gas should be changed and railroad companies compelled to equip all railway postal cars with electricity."

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

A short time since we called attention to the excellent work which was being done by the West Ham (England) Corporation Electricity Supply in the way of getting out a bulletin which was distributed among consumers and prospective consumers of electricity. That the agitation for systematic publicity is assuming greater dimensions abroad is indicated by an editorial and introductory chapter on "Some Practical Notes on the Commercial Development of Electricity Supply Undertakings," by R. Borlase Matthews, in the issue for October 19 of our London contemporary, the *Electrical Review*. Mr. Matthews says: "It is now rapidly becoming an accepted fact that the incorporation of a new-business department into the organization of a public electricity supply undertaking is an absolute necessity. Only a short time ago managers looked askance upon this idea, and though they considered it as possibly a good thing for the large cities, they thought it to be sheer waste of good money and valuable time in the case of the smaller towns, especially those of under 50,000 inhabitants. In time, however, comparisons of the kilowatt-hour consumption per capita in various cities indicated that where an aggressive new-business-getting policy was put into operation the figures soon increased in a very acceptable manner, and likewise the profits, owing to the additional output and the increased load-factor, or, as it is sometimes expressed, the smoothing out of the load curve."

Mr. Matthews calls attention to the organizations of men expert in the work of promoting publicity and in the preparation of technical literature for advertising purposes, and views the evidences which are now found in every central station man's mail as an indication of a very healthy attack which is being made upon the conservatism of the central station operator.

In commenting upon the great development which this new idea has had in so short a time in the United States, Mr. Matthews remarks that "in England so far no similar systematic collective or cooperative efforts have been inaugurated."

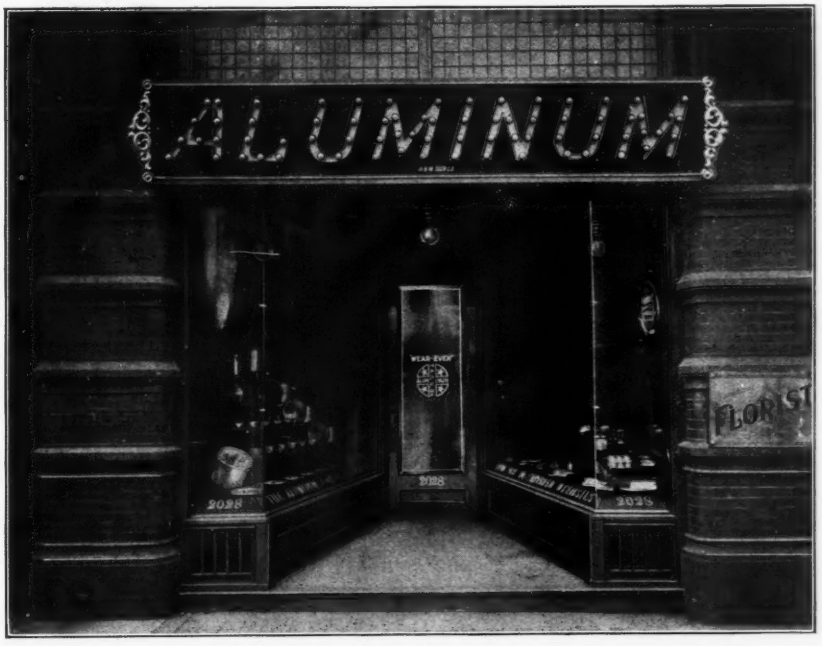
"Compared with other methods of artificial illumination and sources of motive power," Mr. Matthews says, "electricity plays but a small part in its bid for the business of English towns at present. There is no reason for this other than the lack of knowledge on the part of the general public of the possibilities and advantages of electricity, except, perhaps, in certain cases where prices are high; but if the output can be increased these prices can be reduced, as the fixed charges will then bear a smaller and smaller proportion to the total cost of production."

In a second article by the same writer in the following issue of our London namesake, Mr. Matthews makes some suggestions regarding the organization of a new-business department, outlines the system of working, and discusses briefly the art of canvassing. For a town of 20,000 inhabitants or over a man not over thirty-five years of age, with the instincts of a salesman, and who has also been trained in the office of a central station, so that he has some understanding of the conditions of operation and distribution, is suggested as the manager of the new-business department. An attractive office and showroom, where the general public can make inquiries, pay their bills and see actual examples of methods of lighting and various forms of labor-saving appliances, is considered an important auxiliary. The canvassers, Mr. Matthews thinks, need not be very high-priced men, and they should preferably have had experience as travelers or salesmen, not necessarily in the electrical line. In a fairly prosperous town one canvasser per 15,000 inhabitants would seem to be required.

Mr. Matthews thinks that the keynote of modern successful business is system, and that advantage should be taken of all the modern office methods of keeping records. A standard size of card should be used, preferably of thin material, so that it can be easily used in a typewriter.

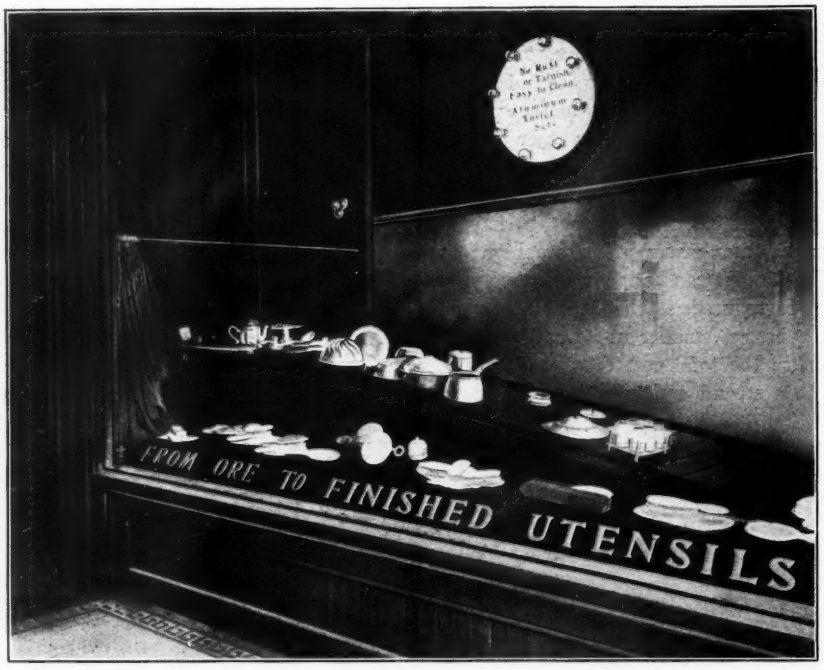
In making a canvass for new business, after every available bit of information concerning the prospect has been properly carded and put in such shape that it is accessible for instant reference, the way for solicitation should be prepared, as far as possible, by suitable advertising, and the day before a call is made a postal card should be sent making mention of the fact, paving the way for a favorable reception.

Whether or not the canvasser is a technical man, he must be thoroughly coached



MOVING WINDOW DISPLAY.

and posted in those matters with which he is to deal. In residence canvassing it is well to endeavor to be allowed to estimate for wiring the house. The specifications should be prepared in two ways, one with the wiring done in the way that best suits the ideas of the householder, and the other in such a manner that the cost is reduced as much as possible by omitting all lights but those which are absolutely necessary.



Moving Window Display.

The accompanying illustrations show an ingenious idea developed by a Cleveland (Ohio) man and utilized for multiplying his available show-window space. The window floor was arranged so that it revolved like an endless chain over two drums at either end. The window floor extended back into the store the depth of the window, the view being shut off by a black velvet curtain. The different articles—some 200 in number—were wired to the moving window floor, and thus a unique and striking effect was produced, attracting the attention of large numbers of pedestrians.

Before this device was installed but fifty pieces could be shown, and that in the old-time stationary style. The device was home-made, simple in design, inexpensive, and driven by a small electric motor concealed below the floor.

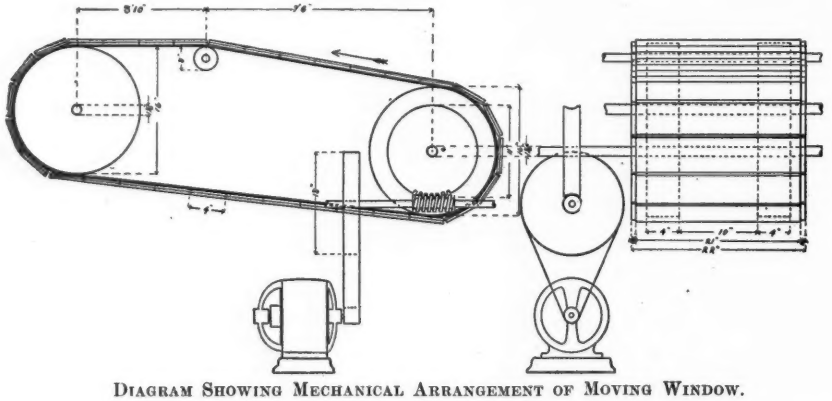


Diagram Showing Mechanical Arrangement of Moving Window.

The Lighting of Railway Cars by Electricity.

One of the changes that will come in with a rush throughout the country in general will be the lighting of all the cars on what are now steam roads, because when all the trains on the trunk lines centering in New York are operated by electricity they will be lighted by the same power—and as the country takes its fashions from New York, so must they follow the lighting fashion. While this change means loss for the gas-lighting companies, it also means a great gain for the companies who make a specialty of train lighting by electricity.

Needless to say, in this matter, as in all others where electricity is introduced, the public becomes the greatest gainers, but it is also true that the railroad companies will benefit, as, in the cost of operating, electricity must surely cost less than gas; while, perhaps, a still greater gain to the railroad companies will be a reduction in the cost of fire insurance, as, eliminating the locomotive fire and the dangerous gas tanks, the loss from fire will be practically eliminated. Another danger, in many cases as great as fire, is the danger of asphyxiation from gas. This, of course, will disappear.

While electric lighting on railways has not progressed as it should, it is bound to be universally adopted; already the national government is moving to have all mail cars lighted by electricity, as in case of wreck the loss of lives of the postal employés and the amount of mail matter destroyed has been great at times, and it is a fact that there is no service more dangerous to life in this country than is the railway mail service. This, of course, is the moving consideration underlying the government action, which took the shape of having a bill for the lighting of all mail cars introduced into the last Congress by the chairman of the Judiciary Committee of the House of Representatives.

The two things that perhaps have retarded the growth of train lighting by electricity have been crudeness of apparatus for this service, aggravated by lack of electrical knowledge and experience on the part of railroads. This is largely disappearing, as to-day American devices lead the world in their simplicity and reliability, and the railroads, at least the most progressive ones, are creating electrical departments in their service, placing at the head of these departments highly trained electricians who can reason as well as act, the action of these men naturally being far more effective than that of the "rule-of-thumb" men who have had much to do with railway lighting in the past to the retardation of the art and increased expense to the railway companies.

By general adoption of electricity for lighting the public will also be benefited by the introduction of fan service on all cars. As the matter stands to-day the country around Chicago is far better served in these matters than is the public around New York, but with electrification on our roads a fact all this will be changed.

J. H. M.

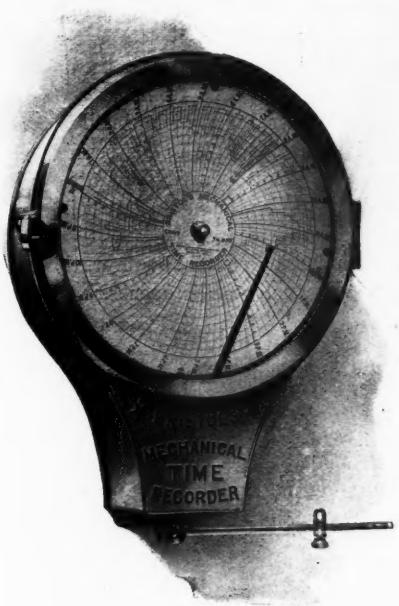
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Mechanical Time Recorders.

To fill the continued and increasing demand for an instrument which makes a graphic record of variations and the time of such variations, of mechanical movements, The Bristol Company, Waterbury, Ct., has placed on the market the instrument illustrated herewith, to which has been given the name "Mechanical Time Recorder." A circular chart revolves by clockwork at uniform speed, while the pen moves over the chart an amount proportional to the motion to be recorded.

The chart is eight inches in diameter, being the same size as on the well-known



MECHANICAL TIME RECORDER.

standard Bristol gauges. Clock movements can be supplied for complete revolution of chart once in fifteen minutes, one hour, two hours, three hours, four hours, six hours, eight hours, ten hours, twelve hours, twenty-four hours, or seven days. The pen arm is rigidly attached at its lower end to a shaft which is turned by a short arm projecting through a slot in bottom of the case. The lever shown in the illustration projecting to the right, is clamped to the short arm by a thumb-nut. Special attention is called to the fact that this lever is adjustable and can be clamped to the arm at any convenient angle. The motion to be recorded after being properly reduced, if necessary, is imparted to the lever, which in turn transmits it to the pen. The total scale on the chart is usually taken proportional to the total motion to be recorded. Reduced motion, if necessary, can easily be arranged by the aid of pulleys, levers or other reducing devices.

Fine adjustments can readily be made by applying the motion at the proper point along the lever, and to facilitate this, a metal attaching piece is provided, which is adjustable on the lever arm and secured in any position by thumb-nut. It will be seen that by the aid of the adjustable lever arm and the adjustable slide on the arm, the instrument is most conveniently adapted to record motions of all amounts and directions.

Total deflection of the pen is obtained by turning the lever through an angle of about twenty-one degrees, or five-inch motion at its outer end.

This instrument can be used to record the rate of motion and position of sluice gates, turbine or engine governors, gate valves, etc. It is also adapted for recording the rise and fall of liquids in tanks, rivers, reservoirs, and fore bay.

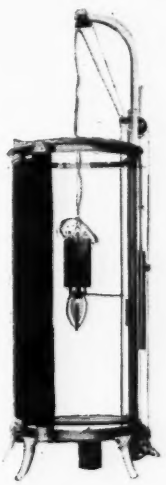
In the gas industry it can be used to check up the operators and thus prevent the "blowing" of the holders either day or night.

Hydroelectric Contract for J. G. White & Company.

The Glastonbury Power Company has awarded a contract to J. G. White & Company, incorporated, engineers and contractors of New York, for the construction of a hydroelectric plant at the Cotton Hollow property on Roaring Brook, near Hartford, Ct. Current will be transmitted probably at a pressure of 11,000 volts to Hartford for light and power purposes and also be supplied in town and vicinity. A hydraulic filled dam, 600 feet long and sixty feet high, will be thrown across the river, from which a fifty-four-inch wooden stave pipe, nearly two miles long, will lead to the power-house, which will be a modern stone building. The pipe will be constructed of California redwood, as this is the best wood obtainable in long clear lengths. Twenty car loads of this lumber will be brought from California for the purpose. Two spiral Francis turbines of 750 horsepower each, will be installed, working under a 200-foot head. Work will be started immediately and it is expected that the plant will be in operation by the first of April next.

A New Electric Blue-Printing Machine.

The accompanying illustration shows a new electric blue-printing machine manufactured by J. H. Wagenhorst & Company, Youngstown, Ohio. The Wagenhorst blue-printing machine is entirely self-contained and occupies a floor space about three feet square. As may be seen from the illustration, the printer is of the cylindrical type, consisting of a glass cyl-



ELECTRIC BLUE-PRINTING MACHINE.

inder with an arc lamp arranged to descend axially through the cylinder, giving an equal light radiation on the interior surface of the cylinder.

When quick exposures are desired a second lamp is suspended immediately below the first lamp. The sensitive paper is, therefore, acted upon simultaneously at two different points, and the whole is exposed in one-half the time taken when but one lamp is used.

The roller curtain device by which the

tracings and sensitized paper are held in place leaves both hands of the operator free to adjust the tracings and the paper. The curtain holds the paper and tracings securely against the glass, so that the rollers can be partly rolled back, permitting an examination of the prints, without in any way disturbing the position of the tracings.

An oil plunger speed regulator is provided, which secures a uniform speed of the descent of the lamp at all times. This also provides a wide range of speed regulation, so that the machine may be adjusted to meet all possible requirements. By means of a valve regulator the speed can be varied either before or after turning on the current. The machine is noiseless in operation and automatically cuts out the lamp current and also stops its descent at the end of its travel.

American-Ball Engines and Generators.

The American Engine Company, Bound Brook, N. J., manufacturer of the American-Ball high-speed engine, both simple and compound, and dynamos and motors, announces the following sales:

Three duplex-compound engines to the Ely Dupont Company, to be used in the new plant at Toluca, Col., making the eighth order from this company for American-Ball engines.

One 200-kilowatt generating set consisting of generator direct-connected to a duplex-compound engine for the American Vulcanized Fibre Company, Wilmington, Del. This is the third order from this company.

Three complete generating sets, two of seventy-five kilowatts and one of 150 kilowatts capacity, driven by duplex-compound engines, for the Cambridge Gas Light Company, Cambridge, Mass.

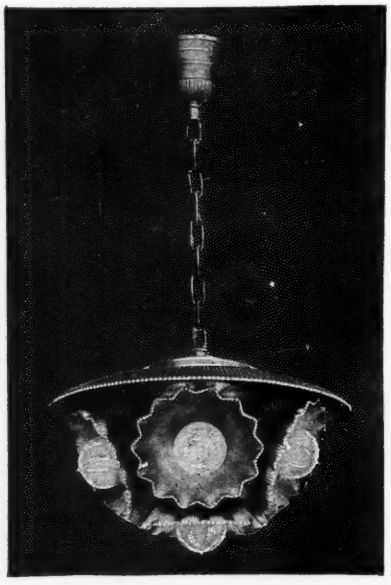
Two 200-kilowatt, direct-current, 500-volt generators and two 125-horse-power and one 300-horse-power motors for W. D. Boyce, Marseilles, Ill.

In building up the armatures of Ball generators provision is made for blocking apart and separating the laminations in the centre of the armature. The coil slots are milled out of the laminated core in the usual manner, and the coils inserted. In separating the teeth of the core formed by the coil slots a patented device is employed, consisting of small slabs of tough fibre board, the shoulders being so beveled that they engage the teeth and hold them apart, maintaining a proper distance between the laminations necessary for the ventilating air duct.

The armature coils are formed of solid bar copper without soldered joints. The insulation consists of double windings of cotton impregnated with insulating compound. The difficulty of bending the bar in shape for the coil has been overcome by a special machine, which receives the long strips of cotton-wound bars from the spool, cuts them into proper lengths for the coils, and bends them edgewise without injuring the insulation. The coils are treated with the insulating compound after they are formed.

The New Holophane Reflecting Arcs.

Considerable attention is being attracted by the new Holophane reflecting arcs which have recently been placed upon the market. The accompanying illustration

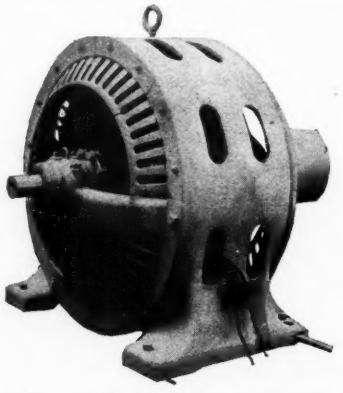


NEW HOLOPHANE REFLECTING ARC.

shows a cluster utilizing the new "Gem" high-efficiency lamp of forty candle-power, consuming 100 watts per lamp. The six-light cluster consumes about the same amount of energy as a five-and-one-quarter-ampere, direct-current, enclosed arc lamp. These reflecting arcs are made up with four, five or six lights. Photometric tests showing the distribution of candle-power have been prepared by the manufacturer of this apparatus, the Holophane Glass Company, whose sales department is at 227 Fulton street, New York city

Western Electric Belted Alternator.

The accompanying illustrations were shown over the titles of induction motors, in an article descriptive of Western Electric alternators in the issue of September 22. These titles were in error, as the illustrations represent the design of the belted alternator of this company.



"S" DESIGN, BELTED TYPE ALTERNATOR.

As a form of construction for alternators, the open slot shown in the unwound stator is used. This form has an advantage in alternators which usually operate at high voltages, due to the possibility of insulating the coils entirely before placing in slot, and also the ease of replacing damaged coils.

In induction motors, however, this company does not use the open slot. Induction motors, usually of low voltage, require very high mutual induction between rotor and stator. This makes the semi-enclosed slot and small air-gap a preferable design in these machines, and the impression given by the unwound stator above referred to as used for an induction motor is erroneous.

"S" DESIGN, BELTED TYPE ALTERNATOR, SHOWING OPEN-SLOT CONSTRUCTION.

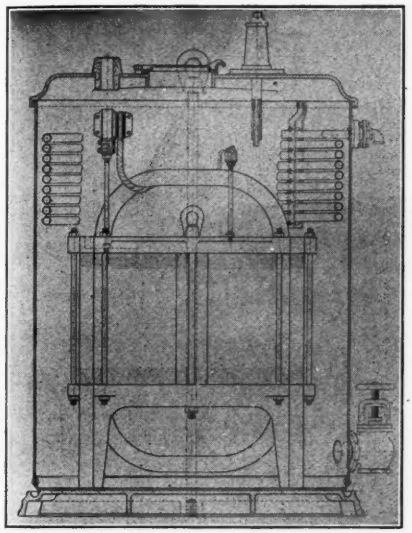
Allis-Chalmers Oil-Insulated Transformers.

The accompanying illustrations show two types of oil-insulated transformers built by the Allis-Chalmers Company, Milwaukee, Wis. Both of these types are oil-filled, but in one case the transformers are water-cooled, and in the other, self-cooled. In the latter type the heat is carried off by radiation from the case, while in the former, water circulation is used to ensure cool running.

The self-cooled transformers are built in sizes up to 300 kilowatts. Above this size the external surface of the case is not sufficient to radiate the heat developed in the transformer core and coils, unless the enclosing tank is made abnormally large.

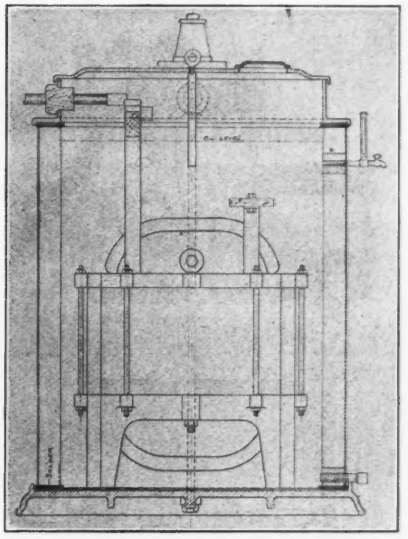
The water-cooled transformers are made in sizes from 100 kilowatts up. Water is circulated in a coil of seamless copper or brass tubing immersed in the oil, and the heat is effectively carried off.

The oil-filled, water-cooled transformers are placed in boiler-plate tanks cylindrical in form and provided with a substantial cast-iron base and cover. The tanks are riveted and caulked, and are supplied with I-bolts extending from the cover to the base, so that the transformers as a whole can be lifted without straining the tank. The cooling coils are made of one and one-quarter-inch tubing without joints throughout the portion immersed in the oil, and all coils are tested with a water pressure of 200 pounds per square inch. The ends of the cooling coils are brought out through stuffing boxes arranged below the oil level. The lower end is thus below

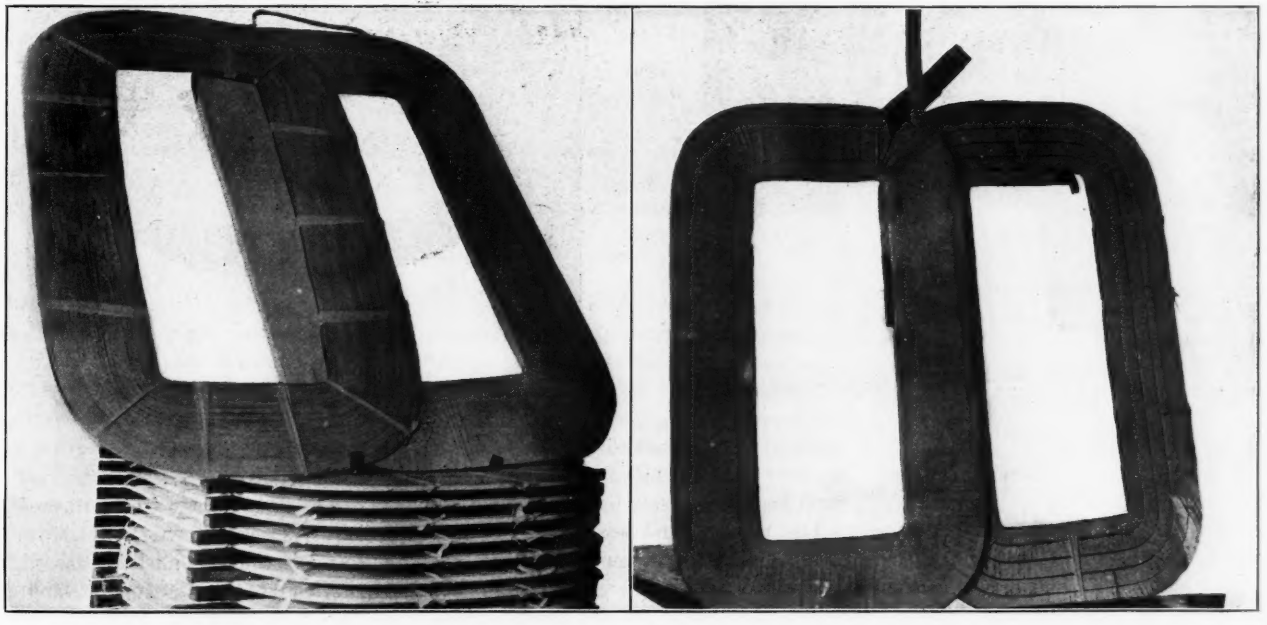


SECTION OF OIL-FILLED, WATER-COOLED TRANSFORMER.

500-KILOWATT, TWENTY-FIVE CYCLE, 405-2,200 VOLTS OIL-FILLED, WATER-COOLED TRANSFORMER.



SECTION OF OIL-FILLED, SELF-COOLED TRANSFORMER.



HIGH-VOLTAGE AND LOW-VOLTAGE COILS OF OIL-FILLED TRANSFORMER.

the level of the lowest coil, so that all water can be easily drained off. The coils are permanently fastened to the case, and are of such diameter that the transformer can be lifted out without disturbing the coils or water connections. The water-cooled transformers are supplied with an oil gauge, drain valve, and thermometer with contacts for an electric alarm attachment that gives a signal in case the temperature exceeds the allowable limit.

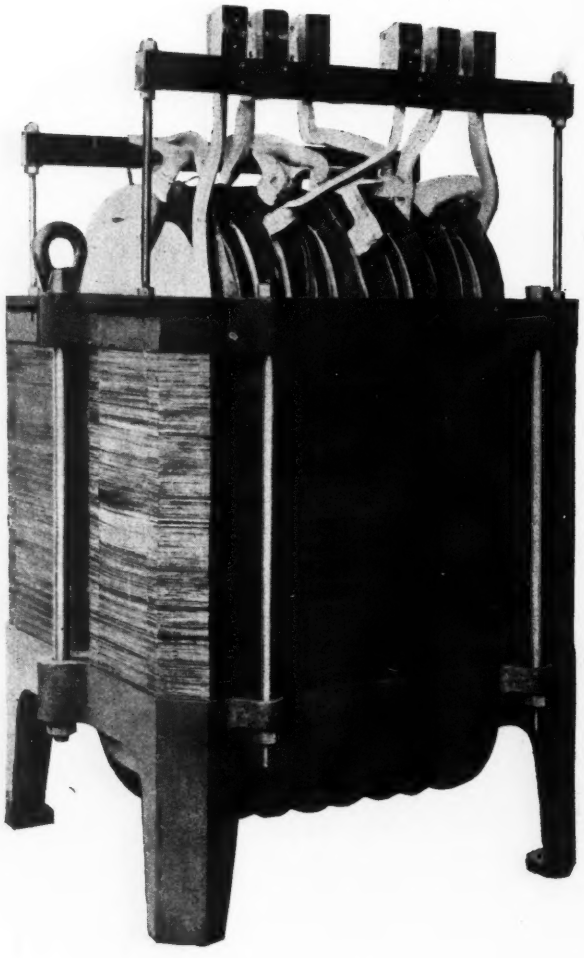
For self-cooled transformers, the case is made of terne-sheet formed into a cylindrical tank with deep corrugations that present a large radiating and cooling surface. The tank has a double bottom made of two flanged pieces of sheet iron riveted together, and the cylindrical corrugated part is soldered into the annular channel-shaped space between the flanges, thus making a tank that is perfectly oil tight. The tank is provided with a substantial cast-iron base and cover, a lid being placed on the latter to allow inspection and give access to the terminal board in case it is necessary to make any changes in the connections.

All transformer coils are wound with double cotton-covered strip copper, one turn per layer, with fullerboard insulation, in addition to the cotton covering, between turns. Exceptions to the foregoing are made only when the size of the conductor is so small as to make this construction impracticable, and in such cases the coils are wound with round double-cotton covered wire with few turns per layer, so that the voltage between layers is kept within safe limits.

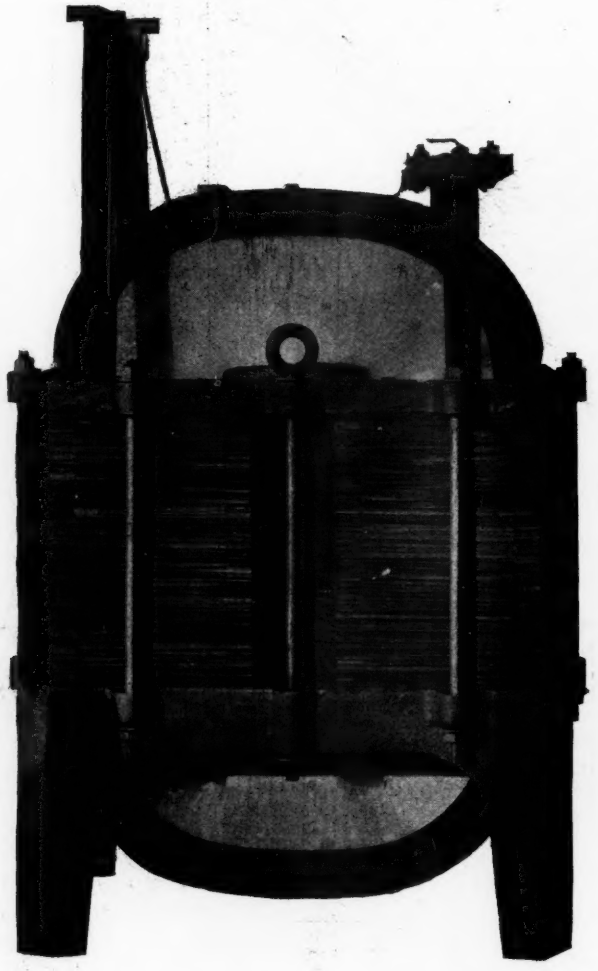
The primary and secondary windings are subdivided into a number of these flat coils which present a large cooling surface to the oil. When the coils are assembled the primary and secondary sections are interleaved. When the conductor is large, several strips are used in parallel and insulated from one another. The coils are neatly and tightly bound with extra long linen tape, and no varnish or insulating compounds are used on the windings.

The transformer core is built up of selected sheet steel 0.014″ thick. The steel is the best obtainable and is thoroughly annealed. The laminations are thoroughly insulated from one another by a coating of varnish. The steel is practically non-ageing, *i. e.*, the core loss does not appreciably increase under long continued operation. In larger sizes space blocks are placed every few inches in the core, providing ducts through which the oil can circulate and carry off the heat.

The oil used in these transformers is a special grade selected after long and careful tests; it contains no acid, has slight evaporation at 100° centigrade, and its flashing point is about 190° centigrade or 375° Fahrenheit. It is a thin oil that circulates rapidly throughout the transformer, quickly carrying off the heat, and its insulating qualities are said to be excellent.



Core and Coils, 500-Kilowatt, 20,000-375 Volts Transformer.



Core and Coils, Oil-Filled Transformer.

The Electrical Equipment of a Modern Steam Laundry.

The Guthman Steam Laundry at Atlanta, Ga., presents an interesting example of the use of electricity for lighting, heating and power, and is a model establishment in this, as well as in other respects.

The building in which the laundry work is carried on was built especially for the purpose and is entirely self-contained, being a brick structure of three floors and a basement, comprising some 24,000 square feet of floor space. The arrangement of the processes in washing and ironing the clothes is somewhat unusual. The basement contains the generating equipment, repair shop and storerooms, while primary washing machines and centrifugals for extracting water from the clothes are located on the top floor, which is, on this account, constructed of cement fourteen inches thick. In this way the first and second stories, used for offices, ironing and drying, are kept entirely free from all odors of boiling clothes and soapsuds which will permeate a building in which the washing is done in the basement.

ELECTRIC IRONS IN A MODERN STEAM LAUNDRY.

In the basement boiler-room are located two 200-horse-power water-tube boilers which supply steam at both low and high pressures, respectively for laundry purposes and for an automatic engine which drives a fifty-five-kilowatt, compound-wound, 110-volt General Electric generator for supplying light and power. On the first floor, in addition to the general offices, are four large mangles each driven by a five-horse-power, direct-connected motor. Individual motor drives are also used on the shirt bosom ironers, body ironers, wristband ironers, moisture-applying machines, etc. The primary washing machines on the third floor, as well as the centrifugals, are grouped and are driven from two lines of shafting, each belted to a fifteen-horse-power motor. Aside from the machine drives, there is also installed an electric elevator which carries the work from the delivery wagons in the basement to the sorting room on the top floor.

It is the hand-ironing department on the second floor, however, where the most interesting use of electricity is evident. Here are installed thirty six-pound and ten three-pound electric flat-irons of the cartridge type built by the General Electric Company. The method of installation is unusually neat and emphasizes the convenience and adaptability of the electric flat-iron over the gas-heated iron. Over each ironing table, as shown in the accompanying illustration, there is a special goose-necked fixture fitted with a four-candle-power indicating lamp, both controlled by a ten-ampere snap switch. This novel arrangement tells at a glance which irons are doing useful work or which are standing idle with the current turned on. Moreover, this method of attachment allows the operator the greatest freedom in the use of the iron.

The electrical equipment of this laundry was installed by the General Electric Company after plans of George Wade as consulting engineer for the Guthman Company. It has been demonstrated by the Guthman Laundry that by the use of the electric irons twenty per cent more work can be accomplished by each operative per working day than that formerly done by the older methods.

Window Lighting.

The Frink special patent window reflector is earning an enviable reputation for store-window lighting and, it is stated, has been adopted by all of the large department stores in New York and other cities. Among others, the following companies have placed orders for the Frink system of show-window lighting: B. Altman & Company, Jas. McCreery & Company, Lord & Taylor, New York city; the May Company, Denver, Col.; Watt, Rettew & Clay, Roanoke, Va.; H. Astrich, Harrisburg, Pa.; Hutzler Brothers, Baltimore, Md.; W. D. Kinsman Company, Springfield, Mass.; D. J. Donahue Company, Missoula, Mon.; M. S. Plaut Company, Danville, Ill.; Sibley, Lindsay & Curr, Rochester, N. Y.; Julius Sycle Sons, Richmond, Va. This line of reflectors is made by I. P. Frink, 551 Pearl street, New York city.

Illustrated Lectures on Illumination.

The illustrated lectures which A. J. Marshall, illuminating engineer, of the Holophane Glass Company, is giving before the central stations and gas companies on the questions of light and illumination, are proving very successful, and it is expected that this work will be the means of greatly assisting the growing demand for the best kind of lights properly placed for desired effects. Mr. Marshall lectured before the West Penn Electric Company, Connellsville, Pa., on Thursday evening, October 25, at which an enthusiastic audience displayed great interest.

The Holophane Glass Company states in this connection that, while this lecturing is planned out for some time ahead, it will, nevertheless, be pleased to consider application for this kind of work and deliver lectures in the order that requests are received.

Current Electrical News

DOMESTIC AND EXPORT.

LIGHT AND POWER COMPANY FLOATED—Capitalists of Columbus and Cincinnati, Ohio, and Salt Lake City, Utah, have organized the Salt Lake Public Service Company, which proposes to supply light, heat and power for Salt Lake. The company has a capital of $3,000,000, with an authorized bond issue of $2,500,000, of which $1,500,000 will be sold in the near future. James J. Chambers, of Salt Lake, is president of the company.

NEW ELECTRIC ROAD—Surveys have been begun at Traverse City, Mich., for the Northern Michigan Traction Company, which will build an electric line 225 miles in length extending from Manistee to Cheboygan, taking in Traverse City, Charlevoix and Petoskey, with several branch lines. The contemplated road will cost $7,000,000, and F. O. Oleson, general manager, announces that there is ample capital behind the scheme. It is proposed to install local systems wherever there is sufficient population to warrant it. The third-rail system, with the overhead trolley in towns, will be used. From Traverse City a branch will run to Old Mission, eighteen miles, and from Petoskey a branch will run to Walloon Lake, East Jordan and Bellaire, connecting with the main line at Elk Rapids.

LIGHT AND TRACTION DEAL—Negotiations in a deal involving millions of dollars have progressed so far that terms for the leasing of the Cincinnati, Covington & Newport Light and Traction Company have been practically agreed upon, and that property will probably soon pass into the control of the Columbian Company, a holding corporation, formed under the laws of West Virginia. This company, which will have a capital of $75,000,000, will also purchase the control of the Union Gas and Electric Company, of Cincinnati, Ohio, the two Cleveland gas and electric properties, and own outright many thousands of acres of oil and natural-gas-bearing lands in West Virginia and a pipe line to Cincinnati. The aggregate capitalization of the subsidiary companies will amount to between $160,000,000 and $175,000,000.

PROPOSED CHICAGO TRACTION IMPROVEMENTS—An ordinance has been prepared by the traction interests operating the Chicago City Railroad Company and the Chicago Union Traction Company, and submitted to the city council's local transportation committee. The companies propose to expend approximately $40,000,000 for reconstruction, provided the ordinance meets with favor. All work is to be carried on under a board of three supervising engineers. It is proposed to expend $5,000,000 for a subway, and more after five years if the board of supervisors sees fit. Provisions are made for the purchase of the lines by the city and a reduction in fares is suggested, provided the city shall reduce the sum to be set aside as compensation. Underground trolleys after five years are made a possibility if the engineers in charge so decide. Spaces are left in the proposed ordinance where the amount of compensation and other figures open for discussion are involved.

LARGE COLORADO POWER COMPANY—The Central Colorado Power Company is in process of organization under the laws of Colorado, for the purpose of acquiring and developing water-power properties on the Grand river in Central Colorado. The company will have a total authorized capitalization, including bonds and stocks, of $42,500,000, made up as follows: Forty-year five per cent bonds, $20,000,000; preferred stock, six per cent, cumulative after January 1, 1910, $7,500,000; common stock, $15,000,000; total $42,500,000. It is proposed to develop, ultimately, 80,000 continuous horse-power. However, in the first instance, 30,000 continuous horse-power will be developed, and for this purpose arrangements are being made to sell $9,000,000 of the bonds. Besides the bonds, $4,500,000 of the preferred stock and $15,000,000, or all, of the common stock will be issued now. The preferred stock is redeemable at 120 after July 1, 1912.

TRACTION SYNDICATE FORMED—A new traction syndicate has been formed to build a long-distance fast-service line from Pittsburg, Pa., down the Ohio river on the west side of the junction with the Beaver river, crossing the Ohio river, one branch going up the Beaver valley to Newcastle, a distance of fifty-two miles, and the other down the river to the new steel town of Midland. This line will compete with the Beaver Valley system of the Philadelphia company. It will connect at Newcastle with the Sharon and Newcastle trolley and will form a part of a Cleveland-Pittsburg system. Grading for the Sharon-Cleveland line is under way and the building of the road will be started early next spring. The entire line will be 150 miles long. The scheme is being promoted by Francis J. Torrance, president of the Standard Sanitary Manufacturing Company; W. H. Hartman, of Elwood City; W. F. Clayton, of Denver, Col., and others. If built it will be a most expensive system, estimates of the cost of construction running up to $20,000,000.

NEW HAVEN ROAD BUYS CONNECTICUT RAILWAYS AND LIGHTING PLANTS—The negotiations for the purchase of the Connecticut Railway and Lighting Company by the New York, New Haven & Hartford Railroad have been completed, and it is announced that the transaction will take effect December 1. The Connecticut Railway and Lighting Company controls a number of electric properties in Connecticut, including 186 miles of city and interurban railway lines. The New Haven & Hartford, within the past few weeks, sold all its holdings in Massachusetts street-railway properties, turning the stock over to the New England Investment and Security Company. This was done because of the opposition in Massachusetts to the control of the electric lines by the railroad company. The Connecticut company has outstanding $9,191,000 common and $5,809,000 preferred stock. Outside of the Consolidated Railway Company, which was the New Haven's holding company for its Massachusetts electric roads, the Connecticut Railway and Lighting Company is the largest combination of electric railway lines in New England.

DEAL FOR MADISON (WIS.) ELECTRIC PROPERTIES—A syndicate of New York capitalists is negotiating for the purchase of the Madison Gas and Electric Company and the Madison and Interurban Traction Company. The purchase, if it is consummated, will involve about $2,500,000. The syndicate will combine the two properties and operate them together. The gas and electric company is owned by the McMillin syndicate, of New York city, which also controls the Milwaukee Gas Light Company and several other lighting properties in Wisconsin. It is believed that the recent decision of the Supreme Court holding that the city of Madison could be empowered by the legislature to fix maximum rates for gas and electricity has had some effect in causing the McMillin syndicate to entertain negotiations for the sale. The Madison & Interurban Traction Company was purchased a little over a year ago by F. W. Montgomery, a New York capitalist. The road has been almost entirely rebuilt, the old rolling stock replaced by modern and up-to-date cars and the service greatly improved. The street-car company has a capital stock of $500,000 and a bonded indebtedness of $685,000, a total of $1,185,000. The capital stock and bonds of the gas and electric company aggregate $1,100,000.

OBITUARY NOTE.

MR. GEORGE HERRING, a prominent English philanthropist, died in London on Friday, November 2. Mr. Herring was chairman of the City of London Lighting Company, the Electric and General Investment Company, the Municipal Trust Company and several mining companies.

ELECTRIC RAILWAYS.

TOPEKA, KAN.—The Topeka & Southwestern Railway Company, the proposed line between Topeka, Eskridge and Council Grove, will be constructed and be ready for operation by September of next year.

BUFFALO, N. Y.—A trolley line connecting the village of Barkers, in the town of Somerset, Niagara county, with Olcott is under consideration. It is said such a line would cost about $150,000.

PEORIA, ILL.—A large appropriation has been voted by the officials of the Rock Island Southern interurban line for an extension from Monmouth to Rock Island. The sum of $1,250,000 was set aside for the work, which will be completed in less than a year.

PORTLAND, ORE.—Two electric railways to Mount Hood are planned to be built within the next two years. One will reach the vicinity of government camp from Portland, and the other will reach the eastern side of Mount Hood in the vicinity of Cloud Cap Inn.

PITTSBURG, PA.—Grading has started on the new trolley line running from Bridgeville to Mount Lebanon. The contractors began work at Bridgeville and will push the work as far as possible this winter. The line is to continue from Bridgeville to Oakdale and later on to McDonald.

ALBANY, N. Y.—The state board of railroad commissioners has approved the application of the New York & Long Island Traction Company for an increase of its capital stock from $1,000,000 to $1,600,000, the increase to be used in buying the stock of the Long Island Electric Railway Company.

MONTGOMERY, ALA.—The Montgomery Traction Company will run an electric-car service from Montgomery to Wetumpka, and it is proposed to extend the line through Tallapoosa county to Anniston some time in the future. Work on the line from Montgomery to Wetumpka will begin next spring. Already the land has been surveyed.

TAYLORVILLE, ILL.—Mayor Leigh has signed the ordinance granting the Springfield & Southeastern Traction Company a fifty-year franchise to operate the road on the streets of Taylorville. The company now has the entire right of way for its proposed route from Pana to Springfield. The company has located its head offices in Taylorville.

LA PORTE, IND.—By unanimous vote of the council of La Porte, a fifty-year franchise was granted to the Chicago-New York electric air line railroad. This franchise will be used by that railroad for the entrance into and terminal in La Porte for their spur track from the main line, which passes about three and one-half miles south of this city.

MUSKEGON, MICH.—Plans have been announced in Muskegon for a new $2,500,000 interurban railway, to be completed for next year's fruit season and to traverse northern Muskegon county, the heart of the Oceana fruit belt, touching at Hart and Pentwater and making Ludington the terminal. E. R. Trowbridge, of Chicago and Detroit, is behind the proposed road.

HAGERSTOWN, MD.—Directors of the electric line running from Pen-Mar to Greencastle have decided to expend between $25,000 and $30,000 in making improvements to the road. Several sharp curves will be eliminated and two large new cars will be purchased. These improvements have been decided upon, in view of the increased traffic coming to the road from the connection with the Hagerstown & Northern at Shady Grove.

WATKINS, N. Y.—The state railroad commission has authorized the Elmira Water, Light and Railroad Company to increase its capital stock from $1,000,000 to $2,000,000 and to issue bonds to the amount of $3,605,000 for the purpose of retiring former bonds and purchasing new properties, including the Glen Route Railway, between this village and Elmira, twenty-two miles in length, now owned by the Seneca Traction Company.

NEW BRUNSWICK, N. J.—Articles of incorporation have been filed for the Perth Amboy & Staten Island Ferry Company, which proposes to operate between Perth Amboy and Tottenville. The new company proposes also to build a new electric railroad across Staten Island. The company has purchased land in Tottenville for its ferry landing and is trying to obtain a landing in Perth Amboy. Its capital stock is $125,000.

SAGINAW, MICH.—Isaac Applebaum, of Detroit, who controls about $410,000, or two-thirds of the bonds outstanding, announces that he will complete the Detroit, Flint & Saginaw electric railroad from Frankenmuth to Flint. The company has been reorganized. The new officers are: president, Isaac Applebaum, Detroit; vice-president, T. G. Sullivan, Detroit; treasurer, M. Mitchkum, Detroit; secretary, C. T. Anderson, Saginaw.

JANESVILLE, WIS.—In special session the council granted a franchise to H. H. Clough, of Elyria, Ohio, who proposes to build the Madison-Janesville electric line. The document gives the right to lay tracks on any and all streets, provided no other companies are thereby excluded, and provides that the local street-railway line be taken over. The privilege of furnishing electricity for light and power also is given Mr. Clough.

HARTFORD, CT.—The Consolidated Railway Company has perfected plans to increase the power capacity for its Meriden and Wallingford division. A substation will be erected north of the North Haven railroad station. This will supply power for the service between Wallingford and New Haven and will relieve the Meriden plant. The Consolidated Railway Company expects to have the trolley line between Rockville and Stafford Springs completed by next July. Several lines of the road at the Stafford end of the line are already finished and a large force of workmen is now pushing construction toward Rockville.

HUNTSVILLE, ALA.—Articles of incorporation of the Huntsville & Birmingham Electric Railroad Company have been filed in the office of the probate judge of Madison county. The company proposes to construct an electric railroad from Huntsville to Birmingham, through Marshall, Cullman and Blount counties, comprising one of the richest mineral, timber and agricultural sections in the South. The proposed railroad will supply the line of road to the South that has always been deemed necessary for the complete development of Huntsville into a manufacturing city. It is understood that strong financial interests are backing the enterprise.

ROCHESTER, N. Y.—A certificate of public necessity and convenience, which carries with it permission to build, has been granted to the Rochester, Scottsville & Caledonia Electric Railway, with head offices in this city, by the state railroad commission. It is expected that the work of securing the right of way and work preparatory to the letting of the contract will be begun without delay. The company is capitalized at $500,000, and practically all of the stockholders are residents of Monroe county. The road will extend from the south line of Rochester through Brighton, Mortimer, West Henrietta, Wheatland and Scottsville to Caledonia.

CASTLE ROCK, WASH.—The Cowlitz Valley Railway and Power Company has been organized for the purpose of utilizing the water powers of Spirit lake and Toutle river and developing the agricultural industries of Cowlitz county. One of the trustees is C. C. Brown, of Castle Rock. No definite plans have as yet been decided upon, but the proposed line has been thoroughly gone over by expert engineers, who pronounce the route as a feasible one. The power developed at Spirit lake will be sufficient for the line, which will probably be electric. It is proposed to build from some point on the Columbia river to the St. Helens mining district, north into the coal district and southwest through Cowlitz valley, opening up several hundred inland towns, among which will probably be Toledo. Work will be commenced not later than next spring.

ALBANY, GA.—At a meeting of prominent Georgia and New York capitalists held in Macon, the organization of a company for the purpose of building an electric railroad from Macon to Albany was perfected. Application for charter will be made at once and the actual construction of the road will be under way in the near future. The new company is backed by ample capital to carry out its plans. The Albanians who are interested in the organization are Joseph S. Davis, N. J. Cruger and S. W. Smith. In connection with the announcement of the organization of the electric railway company comes the definite announcement of the development of the 10,000-horse-power water-power on Flint river two miles north of Albany. The railway company will require about 7,000 horse-power when in full operation, leaving a surplus of 3,000 horse-power to be consumed by local manufacturing enterprises.

ELECTRIC LIGHTING.

WASHINGTON, OHIO—Fairbanks, Morse & Company are installing electric lighting plants in the towns of Shawnee and New Straitsville.

CARBON HILL, ALA.—The town board of Carbon Hill has accepted for the town the waterworks and electric light plant which has been completed at an approximate cost of $30,000.

CHICAGO, ILL.—D. W. Mead has prepared plans for a heat, light and power plant to be built at Channahon, Ill., for the Channahon Power Company, Chicago. It will cost $100,000.

BATAVIA, N. Y.—Stockholders of the Batavia Light and Power Company at their annual meeting elected B. B. Conable, George R. Howard, E. O. McNair and S. W. Warren, all of Buffalo, directors.

CENTREVILLE, MD.—At a special meeting of the town commissioners of Centreville, a perpetual franchise was granted to W. J. Peall, of Wilmington, Del., to erect an electric light, heat and power plant.

COUNCIL BLUFFS, IOWA—Essex has granted a franchise to Oscar Nelson to operate an electric light system for a term of twenty years. Nelson will not build a plant, but will secure the necessary current from Shenandoah.

CADILLAC, MICH.—The Wexford supervisors have voted to grant a franchise to the Electric Land and Development Company of Traverse City, to construct a dam on the Manistee river in Greenwood township. The dam will be located about ten miles from Sherman.

BEATRICE, NEB.—A number of Omaha capitalists have applied for a franchise to operate a gas and electric light plant at Wymore, this county. If a franchise is granted they intend to put in a plant that will cost about $50,000. The present lighting system is unsatisfactory.

HAMBURG, N. Y.—The board of trustees has closed a contract for lighting the village streets for a term of five years, beginning October 1, 1906, H. D. Pierce, of Water Valley, being the contractor. Forty lights are to be used and the price agreed upon is $74.50 for each light per year.

PITTSFORD, N. Y.—The streets of Pittsford are to be lighted by electricity by January 1. The trustees have entered into a contract with the Dispatch Heat, Light and Power Company to furnish twenty arc lights. The contract is for five years and the cost $58.85 for each light per year.

TOLEDO, OHIO—The Toledo Railways and Light Company has been given the contract for the street lighting in Toledo at a price of $45 for each arc light. This price is far below that which has been paid and will result in a saving of $60,000 to the city for each year of the ten-year contract.

COLUMBUS, OHIO—The ordinance providing for the issue of bonds in the sum of $140,000 for the electric light plant has been passed by the council under the agreement that only $90,000 shall be used for the purchase of equipment for the plant, the remaining $50,000 to be used in taking up defective bonds.

CANON CITY, COL.—A contract has been awarded for enlarging the Colorado Light and Power Company's plant at this place. The addition will practically double the capacity of the plant, making it one of the largest concerns of its kind in the state. The capacity of the engines and generators will be increased from 2,500 to 5,000 horse-power.

OGDEN, UTAH—A contract has been closed between the citizens of Huntsville, in Ogden Valley, and the Utah Light and Power Company, by which the latter company agrees to light the town, the work to start at once. The residents of Huntsville will erect the poles and the company is to string the wires, wire the business houses and the residences and furnish the electric current.

CONCORD, N. H.—The property of the Laconia Electric Light Company has been purchased by the Laconia Electric Railway Company. The former company has operated a plant that has supplied electricity for street lighting in Laconia and in the nearby towns of Lakeport, Weirs, Meredith and others. The system will be operated in conjunction with the street railway in the future.

MARQUETTE, MICH.—At the forced sale of the Marquette County Gas Light and Traction Company, conducted at Ishpeming, the property was disposed of to Granger Farwell, of Chicago, holder of the bonds, for $289,000. The company's holdings include a gas and electric light system and a street railway, all three serving the cities of Ishpeming and Negaunee. The only other bidder was R. C. Cornish, representing a Milwaukee concern.

OXNARD, CAL.—The Ventura County Power Company, which controls the gas, water and electric plants of the county, is showing activity in many ways. The corporation is about to build a transmission line to Castaic, at which point it will tap the Kern River line of the Edison company, and from there distribute electricity for light and power throughout the entire county. A new battery of boilers and a new engine have been ordered for the Oxnard plant, to be operated in case of accident to the transmission lines.

SALT LAKE CITY, UTAH—M. F. Pack, of Provo, is contemplating the erection of a power plant in Utah county to supply the people of Provo and other towns in the county with electric light and power. The water to provide the power is contained in the north fork of the Provo river, according to an application filed with the state engineer, and Mr. Pack desires to divert thirty second-feet thereof and convey it a distance of 15,000 feet, where the power plant will be established.

HOBOKEN, N. J.—Announcement is made by the Public Service Corporation that as a result of a reduction in the cost of production brought about by the consolidation of plants and the betterment of facilities, the board of directors has decided to readjust its rate for public and commercial electric and gas service, making a very considerable cut, and also to make a new regulation for its fare zone and transfer system on the trolley lines in this and adjacent counties. The change in railway fares went into effect on November 1. The change in electric service will be made on January 1, 1908.

WINDSOR LOCKS, CT.—The Northern Connecticut Power Company, which has taken over the Windsor Locks Electric Light Company, of this place, the Enfield Electric Light and Power Company, and the Enfield Gas Company, has perfected arrangements to consolidate the business of the two electric companies. The contract has been let for a consolidated plant, which will be located near the present Windsor Locks plant, and which will furnish electric light and power for Windsor Locks, Thompsonville and Enfield. The dimensions of the brick structure will be 52 by 125 feet, and the contract calls for the completion of the plant in January. The company is planning to develop an extensive electric light service in the towns of Windsor Locks, Enfield and East Windsor.

SALT LAKE CITY, UTAH—A franchise has been granted by the board of county commissioners to the Utah County Light and Power Company to erect and operate a pole-line system of wiring for the transmission of electricity over and across the roads and highways of the county outside of the incorporated towns and cities. Under the terms of the franchise, actual construction work is to be commenced by March 1, 1907, and one completed line is to be finished from the power plant to be erected at the mouth of American Fork canyon to Bingham Junction by way of Draper and Sandy. The company agrees to furnish Salt Lake county, free of charge, during the life of the franchise, twenty-five thirty-two-candle-power incandescent lamps, or an equal amount of energy in arc lamps.

SPOKANE, WASH.—The Chelan Electric Company, of which J. T. McChesney, of Everett, Wash., is president, has acquired riparian rights on the Chelan river between Chelan and Chelan Falls, west of Spokane, and will erect a power plant for the operation of an electric railroad from the town of Wenatchee northward along the Columbia river, with a branch to Lake Chelan, and up the Okanogan river to the northern boundary of the state. The power will also be utilized in supplying the town of Chelan with electric lights and water and in lighting the towns of Wenatchee, Waterville, Orondo, Brewster and points along the Columbia river; to pump water for irrigating purposes from the Columbia river, for the purpose of operating the line of the Great Northern from Wenatchee to Seattle, a distance of 160 miles, and for lighting the various towns along the way.

PERSONAL MENTION.

MR. H. B. KIRKLAND resigned his position as general sales manager of the American Circular Loom Company, Chelsea, Mass., on October 16.

MR. E. W. ROBERTS, superintendent of the Washington (Ind.) electric light plant, has tendered his resignation and will enter a general electric supply business in that city.

MR. H. B. PITCHER, of Freehold, N. J., has been appointed manager of the Manapalan Lighting Company, doing business at Englishtown and Freehold. He succeeds W. J. Lansley.

MR. HOMER E. NIESZ, the well-known managing director of the Electrical Trades Exposition Company, Chicago, Ill., has been elected Supreme Neptune for the coming Jovian year of the Rejuvenated Sons of Jove.

MR. GEORGE W. WILDER, Ph.D., has resigned his position as professor of telephone engineering at the Armour Institute of Technology and has opened an office in the Monadnock Building, Chicago, Ill., as a telephone engineer.

DR. C. J. H. WOODBURY was the speaker of the evening at the first monthly dinner of the season of the Boston Boot and Shoe Club, Wednesday evening, October 17, taking as his subject "The Development of the Telephone." Dr. Woodbury's presentation was greatly enjoyed. The address was illustrated by numerous lantern slides and by large models of telephone parts. On Thursday evening, October 25, Dr. Woodbury addressed the Lynn (Mass.) Board of Trade, his subject being "The Business Man and the Telephone."

PROFESSOR CHARLES F. BURGESS has been placed in charge of the department of chemical engineering at the College of Mechanics and Engineering, University of Wisconsin, to which department the courses in applied electrochemistry have been transferred. Among other changes at the university is the resignation of Professor George C. Shaad, who has resigned to take a position at the Massachusetts Institute of Technology; Professor Oliver W. Brown has accepted a professorship at the University of Indiana and is succeeded by Dr. Oliver P. Watts.

MR. ROBERT L. WARNER, who for several years has been New England manager of the Westinghouse Electric and Manufacturing Company, has resigned to enter the firm of Warner, Tucker & Company. Mr. D. Edgar Manson, who has been associated with the Boston (Mass.) office for several years, first as assistant manager, and for the past three years as manager, will have charge of the New England interests of the company, the scope of his office being enlarged to enable him to attend to many of the duties which have been performed by Mr. Warner.

DR. ANDREW FLEMING WEST has declined the invitation to accept the presidency of the Massachusetts Institute of Technology. Dr. West states that "the only reason I can not accept is the increasing clear conviction that I ought to abide by my special work here, a work which has claims upon me as it has upon no one else. This conviction has been emphasized anew by the friendly insistence of the alumni, of my colleagues and of the authorities of Princeton University that I am needed here to develop the growing interests of our graduate school, and by the demonstration of affection made by the students and residents of Princeton."

NEW PUBLICATIONS.

NIAGARA POWER—The Cataract Power and Conduit Company, Buffalo, N. Y., has published a handsome booklet in which are collected a series of testimonials which have been received from users of this power. The booklet is entitled "What the Users of Niagara Power in Buffalo Say of It."

REPORT OF NEW-BUSINESS METHODS TO THE AMERICAN GAS INSTITUTE—The report of new-business methods to the American Gas Institute, at its meeting at Chicago, Ill., October 17, 18 and 19, 1906, has been issued as a handsome volume. This volume is replete with interesting suggestions from the men who are doing the work. The book is made more interesting by the use of portraits of the contributors, and includes portraits of such prominent men in the lighting field as Emerson McMillin and Henry L. Doherty. There are also reproductions of numerous examples of gas advertising and illustrations of showroom display and window advertising.

ELECTRICAL SECURITIES.

A dull and irregular price movement last week gave way toward the close to a decided tendency to climbing and general speculative confidence. Ante-election bugaboos were less in evidence, and with a relief in the monetary condition there would in all probability have been greater advances. The increased dividend in Pennsylvania and the favorable report of earnings by United States Steel, with a new record of unfilled orders, offset any disappointment felt at the failure to increase the dividend on Steel common.

ELECTRICAL SECURITIES FOR WEEK ENDING NOVEMBER 3.

New York:	*Closing.*
Allis-Chalmers common	16¾
Allis-Chalmers preferred	44
Brooklyn Rapid Transit	80⅝
Consolidated Gas	139
General Electric	174
Interborough-Metropolitan common	38
Interborough-Metropolitan preferred	77⅝
Kings County Electric	155
Mackay Companies (Postal Telegraph and Cables) common	71½
Mackay Companies (Postal Telegraph and Cables) preferred	69
Manhattan Elevated	143
Metropolitan Street Railway	105
New York & New Jersey Telephone	124
Western Union	86
Westinghouse Manufacturing Company	154½

Boston:	*Closing.*
American Telephone and Telegraph	138
Edison Electric Illuminating	233
Massachusetts Electric	62½
New England Telephone	128
Western Telephone and Telegraph preferred	80

Philadelphia:	*Closing.*
Electric Company of America	11¾
Electric Storage Battery common	70
Electric Storage Battery preferred	70
Philadelphia Electric	8⅝
Philadelphia Rapid Transit	28
United Gas Improvement	93⅞

Chicago:	*Closing.*
Chicago Telephone	116
Chicago Edison Light	140
Metropolitan Elevated preferred	65
National Carbon common	86
National Carbon preferred	120
Union Traction common	4¼
Union Traction preferred	14½

Chicago Telephone Company's October report showed telephones increased 2,163. Total in use, 165,995.

The National Carbon Company has declared the regular quarterly dividend of 1¾ per cent on its preferred stock, payable November 15.

Both the Northwestern and the Metropolitan roads attained new high records for traffic during the month of October. At the same time the South Side Elevated showed only a slight gain in passenger receipts as compared with the same month last year. The reports are of added interest at this time because the roads are passing through especially important periods. A number of new and far-reaching influences are at work which will have a bearing on the future earnings of all the elevated lines. The turning into trolley lines of the North Side and the Cottage Grove Avenue cable lines and the introduction of the express service on the South Side Elevated appear for the first time as factors in traffic reports. With the Northwestern there was a loss of traffic for a few days after the passing of the cable lines. The trolley service, however, did not prove satisfactory and the elevated regained its lost patronage. The Metropolitan carried a daily average of 142,671, an increase of 10,681, or 8.10 per cent.

TELEPHONE AND TELEGRAPH.

JAMESTOWN, N. D.—The Independent Telephone Company has asked Jamestown for a thirty-year franchise.

KOKOMO, IND.—The Bell and the Citizens' Telephone Companies have merged and will be under one management hereafter.

SCRANTON, MISS.—The Western Union Telegraph Company has laid a new cable across the Pascagoula river from Scranton to West Side.

OMAHA, NEB.—The latest announcement of railroad improvements in Omaha is that the Illinois Central company will construct an independent telegraph and telephone system in Council Bluffs and Omaha.

FORT WAYNE, IND.—The Home Telephone Company is now using its new toll line board which requires the services of five operators instead of three, the former number. The board cost $6,000 and is entirely modern. The old board was sent to the Kendallville exchange.

BOSTON, MASS.—The Southern New England Telephone Company's statement for the three months ended August 31 shows gross receipts of $457,396, expenses of $356,871 and net earnings of $101,525, leaving a balance, after the payment of $82,500 in dividends, of $19,025.

COLDWATER, MICH.—The Southern Michigan Telephone Company, an independent system, has commenced the expenditure of $80,000 on a system to include underground wires in the business section and twenty miles of cable. Coldwater will be the distributing point for southern Michigan and northern Ohio and Indiana.

BRATTLEBORO, VT.—Patrons are being secured for new telephone lines in the towns of Newfane, Townshend, Wardsboro, Brookline and Dover by the New England Telephone and Telegraph Company. An exchange will be established in Newfane, which will be the central for the towns mentioned, and trunk lines will be run from Brattleboro.

COOPERSTOWN, N. Y.—The Rose-Davis Telephone Company is constructing a line from Westford to Maple Valley, a distance of four miles. The company also has a line partly constructed from Otsdawa to West Laurens, a distance of three miles. A line from Worcester to East Worcester is under consideration, but it is not probable that it will be built this fall.

SHELBURNE FALLS, MASS.—At the annual meeting of the Heath Telephone Company the following officers were elected: president, W. E. Kinsman, of Heath; clerk and treasurer, Herbert Newell, of Shelburne Falls; directors, W. E. Kinsman, D. G. Taylor, of Jacksonville; George E. Davis, of Shelburne Falls; F. L. Totman, of Conway; H. Newell and W. A. Barber, of Leyden; S. B. Crafts, of Whateley.

CLEVELAND, OHIO—The Cuyahoga Telephone Company has disposed of an additional $100,000 of preferred stock. The stock was taken by the Ohio telephone syndicate, better known as the Brailey syndicate. The proceeds of the loan will be used to reduce the floating debt of the Cuyahoga Telephone Company. The Cuyahoga Telephone Company has remaining about $100,000 preferred stock which it can sell at any time.

WASHINGTON, D. C.—The signal corps of the army has greatly increased the telegraphic facilities in Alaska and the Philippines the past year. Many wireless stations have been established in both countries, and the chief signal officer, in his annual report to the War Department, announces that they are being operated very successfully. Wireless stations have been established at Zamboanga and Jolo, in the Philippines.

BUTTE, MONT.—The Rocky Mountain Bell Telephone Company will expend $250,000 more in further enlarging and equipping its Butte system, says President George Y. Wallace of the company. Chief among the work to be carried out during the next few months is the erection of a handsome new three-story telephone building; the installation of a new switchboard to cost more than $100,000, and other improvements, including conduits, to cost $68,000.

REDDING, CAL.—Thirteen farmers living on Churn creek, in the Pacheco neighborhood, thirteen miles from Redding, have organized a rural telephone company and will build a telephone line that will connect with the Redding central. Money enough to build and equip the line has been paid into the treasury, and the wires and poles have been ordered. The officers of the corporation, which is called the Pacheco Telephone Company, are: D. W. Hampton, president; W. J. B. Martin, secretary, and W. H. Hill, treasurer.

DALLAS, TEX.—The Southwestern Telegraph and Telephone Company, which operates in Arkansas and Texas, reports as follows: total number subscribers, July 31, 1906, 105,463; gain exchanges, August, 1906, 1,619; gain sublicensees, August, 1906, 670; total number all kinds, August 31, 1906, 107,752; total gain all kinds, August 31, 1906, 2,289; total number exchange subscribers, August 31, 1906, 77,143; total number sublicensees, August 31, 1906, 30,609; total number subscribers, all kinds, 107,752. Total gain January 1 to August 31, 11,162.

CAMBRIDGE, MD.—Articles incorporating the Hoopers Island & Golden Hill Telephone Company have been filed in the office of the clerk of the Circuit Court for Dorchester county. The company proposes to construct a telephone line through Hoopers Island to Golden Hill, and to construct lines from Hoopers Island to other points in Dorchester. The capital stock is $2,500. The incorporators are: William F. Applegarth, Charles R. Mills, Henry A. Phillips, George W. Tyler, John M. Clayton, Alonzo Travers, Oscar A. Keene, John S. Boseman and Benjamin F. Travers.

NASHVILLE, TENN.—Reports have been received by the state comptroller showing the number of instruments now being operated in Tennessee by the Cumberland Telephone and Telegraph Company, the East Tennessee Telephone Company, the Citizens' Telephone and Construction Company, of Lawrence county, and the Benton County Telephone Company, which are subject to state privilege taxes. These reports give some interesting figures and show that there has been a marked increase in the telephone business of Tennessee since last year. Under the assessment laws of Tennessee the telephone companies are required to pay a privilege tax of forty cents per box or instrument in every county of the state having a population of 40,000 or over, a tax of twenty cents per box or instrument in every county having a population of under 40,000. The total number of instruments in the state is now 30,135.

ENGINEERING SOCIETY NOTE.

BOSTON BRANCH, ILLUMINATING ENGINEERING SOCIETY—The meeting held at the American House, October 15, was called to order by President Campbell. It was voted to change the date of regular meetings to the Tuesday following the second Friday of each month. Two papers read at the recent New York meeting were presented for reading and discussion. The first one, on "Application of Photometric Data to Indoor Illumination," by Earnest C. White, was read by A. J. Farnsworth. The second, entitled "Data on Indoor Illumination," by J. E. Woodwell, was read by G. H. Stickney. At the conclusion of the reading a discussion was held, which was participated in by the members. Dr. Louis Bell went into quite a lengthy discussion of these papers. He personally considers the polar diagram with slide rule, etc., a very convenient combination for measuring illuminating effects at different angles. He also spoke of the relatively small value which could be attached to the law of cosines and made a number of practical demonstrations along these lines, illustrating that the useful light must largely fall on the object illuminated upon a normal plane. G. H. Stickney spoke of many experiments along the line of increasing the light sources and utilizing reflectors of such shapes as to lower the intrinsic brilliancy and spread the illumination over larger surfaces, reflected at suitable angles to the space illuminated. Dr. Charles Williams spoke of the injurious effects of general illumination upon the human eye, and criticized the general tendency to have a strong light, too closely concentrated, especially when located in the normal range of sight. He emphasized the necessity of greater diffusion and lower intrinsic brilliancy. He mentioned several experiments for determining the amount and location of light for certain classes of work. J. S. Codman demonstrated the method of calculating illumination, using a set of curves which he had personally plotted and which give a rapid way of determining the amount of illumination necessary. He regarded the paper of Mr. Woodwell as very practical and valuable. The discussion was further entered into by A. J. Farnsworth, C. J. Hatch, Edison Cowles and W. E. Clarke.

NEW MANUFACTURING COMPANIES.

HARRISBURG, PA.—A charter has been granted to the Philadelphia Electrical and Manufacturing Company, with a capital of $75,000.

NEW YORK, N. Y.—The Hudson Electric Specialty Company has been incorporated to manufacture electrical machinery and appliances. The capital is $15,000. The incorporators are Wilfred A. Hennessy, Walter G. Hocke and James J. Underwood, all of New York city.

WORCESTER, MASS.—The Worcester Electrical Contracting Company has been incorporated under the laws of Massachusetts to do a general electrical contracting business and to deal in electrical supplies in Worcester. The capitalization is $10,000. Roger T. Williams is president and Clarence W. Hobbs, Jr., treasurer and clerk. They, with Dr. Lamson Allen, comprise the directors.

NEW INCORPORATIONS.

LANSING, MICH.—Western Michigan Light and Power Company, Manistee. $500,000.

OLYMPIA, WASH.—Northwest Light and Power Company, of Spokane. Increase of capital stock to $600,000.

BAKER CITY, ORE.—Baker Valley Land Company. $10,000, all subscribed and paid. To buy and sell real estate, water and power plants, etc. Incorporators: Davis Wilcox, of Haines; J. K. Romig, of Baker City, and N. U. Carpenter, cashier of the Citizens' National Bank, Baker City.

ALBANY, N. Y.—The Lake Erie Electric Traction Company. $400,000. To take over the property and franchises of the Lake Erie Traction Company and the South Shore Suburban Railway Company. Principal office: Westfield, Chautauqua county. Directors: Alexander Keogh, Ashley T. Cole, James A. Byrne, R. W. Yates, J. S. Cloonan, W. J. Bagnell, Arthur McCausland, D. P. Bergheimer, and C. H. Wener, of New York city.

ALBANY, N. Y.—West Shore Traction Company. $2,500,000. To operate a surface line between Orangetown, Piermont, Grand View, South Nyack, Upper Nyack, Congress, Haverstraw and other places in Rockland county. Directors: Frank J. Whan, A. H. Whan, E. J. Welsh, M. C. Heine, G. P. Fall, G. S. Fulton, of New York city; A. S. Brown, Brooklyn, E. G. Roff, Jr., Orange, N. J.; E. A. Hilton, Paterson, N. J.

INDUSTRIAL ITEMS.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., in bulletin No. 1508 describes and illustrates Christensen straight air-brake equipments.

THE JEFFREY MANUFACTURING COMPANY, Columbus, Ohio, has established a new Canadian branch in Montreal, Canada, at Lagauchetiere and Cote streets.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has issued from its supply department a very complete catalogue of railway supplies. This is designated as catalogue No. 7601.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., will be pleased to send to anyone interested upon request its new pamphlet entitled "Small Motors and Motor Applications."

THE H. T. PAISTE COMPANY, Philadelphia, Pa., has ready for distribution a new bulletin describing and illustrating Fielding receptacles. There is also a new discount sheet and new prices on cartridge cutouts.

A. GROTHWELL, 2517 Castro street, San Francisco, Cal., is calling attention to the "Mogul" products. These include armature varnishes, driers, acid and alkali-proof compounds, and insulating oils and varnishes.

M. W. DUNTON & COMPANY, Providence, R. I., announce that they are making a special offer on their regular cotton sleevings for electrical purposes. Notwithstanding a high cotton market, the company announces a very attractive proposition.

THE H. KRANTZ MANUFACTURING COMPANY, Brooklyn, N. Y., has published a handsome panel-board catalogue for architects and engineers. In addition to a number of striking half-tone reproductions there are given full data concerning the physical characteristics of this apparatus.

THE CENTRAL ELECTRIC MANUFACTURING COMPANY, Rock Island, Ill., is calling attention to the "Black Hawk" dry battery. This battery has a corrugated zinc cell giving a large surface, and it is claimed that it has an initial high voltage, high amperage, great recuperative powers and long life.

THE FOSTORIA GLASS SPECIALTY COMPANY, Fostoria, Ohio, has issued a handsome catalogue devoted to "Noblac" inner globes for enclosed arc lamps. In addition to the text, which is very carefully arranged, there are numerous line drawings showing the various forms of inner globes manufactured by this company.

THE ELECTRIC SERVICE SUPPLIES COMPANY, Chicago, Ill., has published an attractive booklet, designated as the "Keystone Traveler," calling attention to a number of the company's specialties. A very interesting group of the company's representatives, taken at Columbus, Ohio, during the recent street-railway convention, is shown.

THE CINCINNATI MILLING MACHINE COMPANY, Cincinnati, Ohio, has published a catalogue devoted to examples of rapid milling. The text is supplemented by many half-tone reproductions showing belted and motor-driven millers in service applications. Altogether, the volume comprises sixty examples of machining of this character.

THE BUCKEYE ELECTRIC COMPANY, Cleveland, Ohio, manufacturers of incandescent lamps, has issued recently a special bulletin devoted to each of the following new types of lamps: the Buckeye "Gem Focul" lamp, the Buckeye "Gem" lamp and the Buckeye "Tantalum" lamp. In addition to this the company has issued a bulletin descriptive of the "Standard" Buckeye type of incandescent lamp.

THE ELECTRO-DYNAMIC COMPANY, Bayonne, N. J., has ready for distribution several new bulletins dealing with the "Inter-Pole" motor. One of these bulletins is devoted to reproductions of testimonials from users of this apparatus and another is a reprint of the American Institute of Electrical Engineers paper by C. H. Bedell, entitled "Direct-Current Motor Design as Influenced by the Use of the Inter-Pole."

THE GENERAL STORAGE BATTERY COMPANY, 42 Broadway, New York city, has increased its business to such an extent that it has been obliged to enlarge its present works at Boonton, N. J. Additional generating units are being installed, and the additional switchboard equipment consists of twenty-one generator and feeder panels. The new building which is being added will be a structure of five stories and basement, for which a separate power station will be erected.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., has shipped within the last few months nine carloads of electrical machinery, exclusive of other smaller shipments, to the following large companies: four carloads to the National Tube Company, including motors of various sizes; two carloads to the Lehigh Portland Cement Company, one of direct-current generators and a number of motors of various sizes; two carloads of alternating-current generators to the Snow Steam Pump Company, and one carload of form L small motors to the Crocker-Wheeler Company's San Francisco office. This last shipment is to fill part of the company's orders taken since the fire.

THE HOOVEN, OWENS, RENTSCHLER COMPANY, Hamilton, Ohio, has licensed the Felten-Guilleaume, Lahmeyer Werke, Frankfort-on-Main, Germany, to build the Hamilton-Holzwarth turbine throughout Germany. This German company is one of the largest electrical concerns in that country. It has a capital of $20,000,000, and manufactures both water and steam turbines, wire cables, generators, motors and all classes of electrical machinery. It has recently secured control of Escher, Wyss & Company, of Zurich, Switzerland, thus controlling the Zoelly steam turbine syndicate of Germany. The manufacture of the Hamilton-Holzwarth turbine has been taken up after a careful investigation and after an exhaustive series of tests made at the University of Darmstadt.

THE DOWNWARD LIGHT ELECTRIC COMPANY, Union square (east), New York, is pressing the introduction of its new forty-watt downward lamp. For this lamp the claim is made that

it reaches the highest efficiency in light distribution, economy, current consumption and useful life. The company also claims for this lamp that, compared with the most efficient 3.1-watt ordinary sixteen-candle-power lamp, it shows twenty per cent less current consumption, seventy-one per cent more downward light and 145 per cent longer life. In connection with this lamp, the company publishes the following statement: "In your search for higher efficiency, do not forget that light rays travel in straight courses and that illumination means light actually used, not light distributed where it is not required. What you should figure is the efficiency of light used—illumination."

THE SARCO COMPANY, 906 Sixth avenue, New York city, reports excellent success in the introduction of its electric lighting specialties, particularly the Sarco pendant switch. This switch is only about two inches in size and conforms to the National Electrical Code standard. It was patented in the early part of the present year, yet the manufacturers report that the demand for it is almost universal. Among some of the other specialties made by this company are the "Noscru" push button, the Sarco swiveling and separable attachment plug, the "Noscru" key-arm switch and the Sarco outlet box. The Sarco company is one of the younger manufacturing companies producing and introducing electrical specialties, yet under the personal direction of Ralph A. Schoenberg its growth has been rapid and substantial. Its success may perhaps be attributed to the fact that Mr. Schoenberg is at the head of a large electrical contracting business, contact with which has given him practical ideas as to the requirements in practical design and operation for such specialties as the company offers.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the Second Issue of Each Month.)

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Cosmos Club, Washington, D. C.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. C. E. Skinner, New Haven, Ct.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, S. S. Sadtler, 59 South Tenth street, Philadelphia.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 95 Liberty street, New York. Meetings, fourth Friday of each month.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West 116th street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

AMERICAN ROENTGEN RAY SOCIETY. Secretary, Dr. G. C. Johnston, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Professor Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 12 West Thirty-first street, New York. Annual meeting, December 4-7, 1906.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, 60 Wall street, New York.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, S. W. Mower, London, Canada.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Ernest H. Davis, Williamsport, Pa.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Milwaukee, Wis. Annual meeting, Atlantic City, N. J., June 19, 1907.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, Welles E. Holmes, 308 Washington street, Newton, Mass. Annual meetings held in Boston on third Wednesday in March.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Toronto, Ontario.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. F. Dostal, Denver, Col.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, E. W. Poole, Bridgeport, Ct. Annual meeting in November, 1906.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt street, New York.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, John P. Faure, 77 Water street, Ossining, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine street, St. Louis, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary-Treasurer, George H. Erich, 401 Monadnock Block, Chicago. Next annual meeting, Chicago, January, 1907.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays each month.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada. Next annual meeting, January 14, 1907.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliot, Claus Spreckles Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall street, New York. Board of Directors meets second Friday of each month.

EMPIRE STATE GAS AND ELECTRICAL ASSOCIATION. Secretary, Rolland A. Davidson, 58 William street, New York city, N. Y.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Dr. Arthur H. Elliot, 4 Irving place, New York. Meetings in New York, second Friday of each month.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntingburg, Ind.

INDIANA ELECTRIC RAILWAY ASSOCIATION. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Tuesday of each month.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Norfolk, Va.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. L. Tetu, Nashville, Tenn.; assistant secretary, J. A. Harney, Electric Building, Cleveland, Ohio.

IOWA ELECTRICAL ASSOCIATION. Secretary, L. B. Spinney, Iowa State College, Ames, Iowa.

IOWA STREET AND INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

IOWA TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Iowa.

KANSAS GAS, WATER AND ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Topeka, Kas., October 16, 1907.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. W. Chambers, Winchester, Ky.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby street, Boston, Mass. Meets second Wednesday of each month, except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James F. Barnett.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 94 Genesee street, Utica, N. Y. Next meeting, New York city, 1907.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, W. C. L. Eglin, 136 Liberty street, New York city.

NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION. Annual meeting, New York city, October 23-24.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State street, Boston, Mass.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 114 Liberty street, New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. Max Eaton, Niagara Falls, N. Y.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, B. C. Adams, Madison, Wis.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Portsmouth, Ohio.

OHIO SOCIETY OF MECHANICAL ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Bullard, Cleveland, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OLD TIME TELEGRAPHERS AND HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York city.

ORDER OF THE REJUVENATED SONS OF JOVE. C. B. Roulet, Mercury, Dallas, Tex.

PACIFIC COAST ELECTRICAL TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa. Annual meeting, Milwaukee, Wis., October 14, 1907.

SOUTHWESTERN GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION. Secretary, T. H. Stuart, Waco, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. B. Fairchild, Jr., 114 Liberty street, New York city.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Buzzell, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electrical Light Company, Middlebury, Vt.

VIRGINIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, B. L. Fisher, Rocky Mount, Va.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, Chicago.

WESTERN SOCIETY OF ENGINEERS (Electrical Section). Secretary, J. H. Warder, 1737 Monadnock Block, Chicago, Ill.

DATES AHEAD.

Electrical Trades Exposition. Chicago, Ill., January 14-26, 1907.

Northwestern Electrical Association. Milwaukee, Wis., January 16, 1907.

American Society of Mechanical Engineers. New York city, December 4-7.

Record of Electrical Patents.

Week of October 30.

834,264. TIME-RELEASING DEVICE FOR LEVERS CONTROLLING RAILWAY APPLIANCES. John P. Coleman, Edgewood, Park, Pa., assignor to The Union Switch and Signal Company, Swissvale, Pa. Filed July 16, 1906. The final movement of the dash-pot piston releases the lock.

834,272. TELEPHONE SYSTEM. William W. Dean, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed December 29, 1902. A common battery system with diagonally connected cord circuits for signaling one or the other of two stations.

834,274. ELECTRIC-PUMP GOVERNOR. Edward H. Dewson, Edgewood Park, Pa., assignor to The Westinghouse Air Brake Company, Pittsburg, Pa. Filed August 22, 1905. Makes use of an electromagnet opposing the fluid pressure.

834,302. TROLLEY WHEEL. Henry L. Humphrey, Monroe, Mich. Filed November 13, 1905. A split wheel is mounted on a fixed spherical pinion.

834,336. AUTOMATIC ELECTRIC BRAKING. Louis H. Thullen, Edgewood, Pa., assignor to The Union Switch and Signal Company, Swissvale, Pa. Filed December 22, 1903. A stop placed beside the track short-circuits the motor through a switch on the car.

834,352. CASE FOR LOADING-COILS. Henry F. Albright, New York, N. Y., assignor to Western Electric Company, Chicago, Ill. Filed April 22, 1905. The telephone loading-coils are supported on a spider carried by the inner wall of the case.

834,355. MAGNETIC POWER CONTROL. Daniel Bacon, Brooklyn, N. Y., assignor to Magnetic Control Company, New York, N. Y. Filed January 28, 1905. A variable-speed magnetic gear.

834,392. STRAIN-INSULATOR. George A. Mead, Mansfield, Ohio. Filed April 22, 1905. Allows the strain to be adjusted.

834,404. SIGNALING SYSTEM. Frank B. Rae, Ridgewood, N. J., assignor to Rae Electric and Manufacturing Company. Filed August 5, 1901. An automatic signaling system controlled by the position of the car.

834,406. LAMP-SOCKET FOR CEILINGS. William H. Rattenbury, Chicago, Ill. Filed September 30, 1905. A countersunk socket.

834,424. RESISTANCE DEVICE. William L. Waters, Milwaukee, Wis., assignor to National Brake and Electric Company, Milwaukee, Wis. Filed April 28, 1905. The resistance units are supported on a frame submerged in an insulating fluid.

834,449. ELECTRIC LIGHT HANGER. James W. Carter, Abilene, Tex. Filed May 11, 1906. An adjuster for cord drop lights.

834,480. COIL-FORMER. Julius W. Lundskog, Lynn, Mass., assignor to General Electric Company. Filed March 25, 1904. A former composed of a number of superimposed laterally displaced slabs.

834,496. OSCILLATING-CURRENT LAMP. James E. Seeley, Los Angeles, Cal., assignor to Synchronous Static Company, Los Angeles, Cal. Filed July 12, 1905. The secondary coil is enclosed within the primary and is connected to the discharge electrodes.

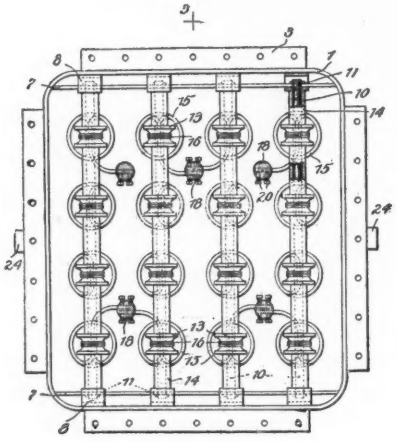
834,497. TRANSMITTING APPARATUS. Harry Shoemaker, Jersey City, N. J., assignor to International Telegraph Construction Company. Filed January 2, 1906. The alternating current employed holds the key closed until it falls nearly to its minimum value.

834,525. VOLTAGE REGULATOR. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Com-

pany. Filed June 12, 1905. Renewed April 28, 1906. A variable voltage transformer, the connections of which are controlled through electromagnet switches.

834,533. INSULATOR. James F. Nichols, Plainfield, Ark., assignor of one-half to C. D. Stevens, Magnolia, Ark. Filed September 11, 1905. A split insulator held together by the holding bolts and a strap.

834,538. SYSTEM AND APPARATUS FOR MEASURING TELEPHONE SERVICE. Harold D. Stroud, Chicago, Ill., assignor to The Stroud International Measured Service Company, St.



834,424. RESISTANCE DEVICE.

Louis, Mo. Filed May 13, 1904. The user registers a charge, but the operator can set the instrument so that it will not charge for the next call.

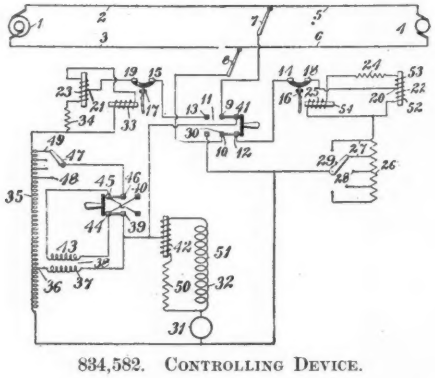
834,563. ELECTRIC MOTOR-CONTROL SYSTEM. William Cooper, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed May 22, 1905. A system for controlling a group of two or more electric motors.

834,567. INSULATOR. Richard A. Falkenberg and Solomon S. Simon, San Francisco, Cal. Filed August 29, 1905. An insulator with a peculiarly shaped slot.

834,570. SYSTEM OF TRANSMITTING POWER. George P. Finnigan, Greene, N. Y., and George T. Hanchett, Hackensack, N. J.; said Hanchett assignor to said Finnigan. Filed August 30, 1905. Makes use of a step-by-step motor.

834,580. SPARKING PLUG. Jere G. Kingsbury, West Orange, N. J. Filed May 3, 1905. A method of construction.

834,582. CONTROLLING DEVICE. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 3, 1905. A system for use on alternating or direct currents with means for automatically disconnecting each circuit when the energy supplied to it is not of the kind for which it is adapted.



834,582. CONTROLLING DEVICE.

834,626. UNLOADER FOR SINGLE-ACTING COMPRESSORS. Frederick Van Duzer Longacre, New York, N. Y., assignor to Ingersoll-Rand Company, New York, N. Y. Filed November 23, 1904. A discharge valve, opened by an electromagnet.

834,636. ELECTRICAL CONTACT FOR TROLLEY SYSTEMS OF ELECTRIC RAILWAYS. Wesley T. Oviatt, Stratford, Ct., assignor to William Grunow, Jr., Bridgeport, Ct. Filed August 29, 1905. A similar device adapted for a compound compressor.

834,659. TELEGRAPH CUT-OUT. Fred A. Clogston, Bridger, Mont. Filed November 11, 1905. A cut-out for a common return with means for disconnecting any circuit from it.

834,664. BASKET FOR INCANDESCENT ELECTRIC LIGHT BULBS. Charles Duncan, Montreal, Quebec, Canada, assignor to The Duncan Electrical Company, Limited, Montreal, Canada. Filed December 7, 1905. A wire lamp-guard.

834,669. TEST AND WIRE-CONNECTOR. William A. Fricke, Chicago, Ill. Filed October 24, 1904. A clamp formed of a bolt and several plates.

834,684. CONNECTOR FOR CONDUITS FOR ELECTRIC WIRES. Clarence C. Sibley, Perth Amboy, N. J., and George A. Lutz, New York, N. Y. Filed July 18, 1904. A device for locking conduits in the boxes.

834,685. CONDUIT FOR ELECTRIC WIRES. Clarence C. Sibley, Perth Amboy, N. J., and George A. Lutz, New York, N. Y. Filed October 26, 1905. A rectangular conduit with removable cover.

834,686. BASE FOR SUPPORTING SWITCHES AND THE LIKE UPON CONDUITS. Clarence C. Sibley, Perth Amboy, N. J., and George A. Lutz, New York, N. Y. Filed October 26, 1905. A base suited to be attached to conduits.

834,687. ELBOW FOR CONDUITS. Clarence C. Sibley, Perth Amboy, N. J., and George A. Lutz, New York, N. Y. Filed October 26, 1905. An elbow with a sharp corner.

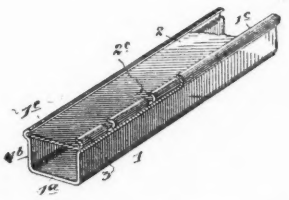
834,689. RAIL-BOND. Charles R. Sturdevant, Worcester, Mass., assignor to American Steel and Wire Company, Worcester, Mass. Filed July 7, 1905. The solid bond-head is provided with the boss on its outer face.

834,690. RAIL-BOND. Charles R. Sturdevant, Worcester, Mass., assignor to American Steel and Wire Company, Worcester, Mass. Filed July 7, 1905. The bond-stud is caulked in position.

834,695. FAN-MOTOR SUPPORT. Harold R. Wellman, Chicago, Ill., assignor to Western Electric Company, Chicago, Ill. Filed April 22, 1905. A stand admitting of considerable adjustment of the motor.

834,708. SECONDARY ELECTRIC CLOCK. Henri Campiche, Geneva, Switzerland. Filed May 24, 1905. The clock is driven by an electromagnet through a ratchet wheel.

834,742. CONDUIT FOR ELECTRIC CONDUCTORS. George A. Lutz, New York, N. Y. Filed October 26, 1905. A rectangular conduit with removable cover.



834,742. CONDUIT FOR ELECTRIC CONDUCTORS.

834,750. VOLTAGE-REGULATOR. Thomas M. Pusey, Kennett Square, Pa. Filed July 19, 1904. The regulating rheostat is operated by a motor controlled by an electromagnet.

834,787. METER. Joseph Wills and Lorin E. Imlay, Niagara Falls, N. Y., assignors of one-third to The Niagara Falls Power Company, Niagara Falls, N. Y. Filed June 21, 1904. A registering wattmeter.

834,829. MEANS FOR HOLDING RECEPTACLES AND THE LIKE TO CONDUITS. George A. Lutz, New York, N. Y. Filed September 14, 1905. A cap of insulating material for attaching to conduits.

834,832. MEANS FOR CHARGING STORAGE BATTERIES OF TELEPHONE SYSTEMS. Talbot G. Martin, Chicago, Ill., assignor to Automatic Electric Company, Chicago, Ill. Filed February 3, 1905. A system of charging the storage batteries at one automatic telephone exchange from a second.

834,844. WIRE-COUPLING. Alfred Oskamp, Wyoming, Ohio, assignor to The Kisinger-Ison Company, Cincinnati, Ohio. Filed September 18, 1903. A sleeve with one side thickened against which the locking keys press.

834,869. TELEPHONE SIGNALING APPARATUS. William E. Butler and Morgan L. Lane, David City, Neb. Filed January 3, 1906. A selective signaling device.

834,870. AUTOMATIC CONTROLLING MEANS FOR FLUID-PRESSURE SYSTEMS. Jacob C. Chamberlain, New York, and Albert T. Marshall, New Rochelle, N. Y., assignors, by direct and mesne assignments to The Automatic Refrigerating Company, New York, N. Y. Filed June 21, 1905. A fluid-pressure expansion tube operates the motor starting switch.